CANADA'S URBAN INFRASTRUCTURE

PHYSICAL CONDITION AND FUNDING ADEQUACY

Prepared for the Federation of Canadian Municipalities'
Task Force on Municipal Infrastructure
by the
Technical Committee on Canada's
Urban Infrastructure
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Mayor M. Harcourt,
Chairman, and Members,
FCM Task Force on Infrastructure.

Dear Mayor Harcourt:

Contained, herein, is the report on Canada's Urban Infrastructure prepared for your Task Force by the Technical Committee listed on the inside cover of the report.

The Committee, comprised of members from all regions of Canada, was formed in January, 1984. It has reviewed existing studies on this subject, carried out a survey of Canadian municipalities to update existing information and drawn on the experience of its members to assess the condition of Canada's municipal infrastructure, funding adequacy and trends. Within the limited time available, it has been possible to carry out a preliminary assessment of the problems that exist, their causes and possible corrective measures. For the most critical areas of sewers, water, streets and bridges, estimated costs to bring the facilities to acceptable levels of condition have also been provided. This constitutes Phase I of the study.

Phase II, if approved by the FCM, will analyze in greater detail the problems identified in Phase I. It will also outline specific FCM policies for dealing with the problem, programs to correct deficiencies in the infrastructure and means of cooperation between the three levels of government in solving the problem.

Respectfully submitted
Technical Committee on
Canada's Urban Infrastructure

WM. Curtis

W.H. Curtis, Chairman

TABLE OF CONTENTS

		Page
I.	EXECUTIVE SUMMARY	i
II.	INTRODUCTION	1
III.	INFORMATION FROM OTHER SOURCES	8
IV.	MAYORS' PRESURVEY RESULTS	15
V.	MUNICIPAL INFRASTRUCTURE SURVEY RESULTS	20
VI.	FEDERAL TRENDS	64
VII.	TECHNICAL COMMITTEE DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS	66
VIII.	ACKNOWLEDGEMENTS	83

APPENDICES

APPENDIX A - Literature Review of Municipal Infrastructure

APPENDIX B - European Municipal Infrastructure

APPENDIX C - Sample Questionnaires and Follow-up Letters

APPENDIX D - Summary of Municipal Infrastructure Respondents

APPENDIX E - A Profile of Federal Government Support for Municipal Infrastructure in Canada

LIST OF FIGURES

		Page
1.	Canadian Mayors' Perception on Whether Funding for the Maintenance of the Intrastructure is Being Achieved -----	17
2.	Canadian Mayors' Perception on the Best Economic Strategy for Dealing with Infrastructure Problems -------	17
3.	Canadian Mayors' Opinions on the Deterioration of Municipal Facilities ----------	18
4.1	Survey Response (Number of Municipalities by Size) ------	24
4.2	Survey Response (Population of Municipalities by Size) ----------	24
4.3	Survey Response (Number of Municipalities by Region)-----	25
4.4	Survey Response (Population of Municipalities by Region) ----------	25
5.	Infrastructure Condition ----------	29,30
6.	Budget Priority ----------	31
7.	Change in Condition ----------	32
8.1	Municipal Budgets (1983 $ per Capita - ENR) ----------	37
8.2	Municipal Budgets (1983 $ per Capita - CPI) ----------	37
9.	Sources of Revenue (Population Weighted) ----------	40
10.1	Infrastructure Needs (Per Capita Cost by Facility) ------	43
10.2	Infrastructure Needs (Per Capita Cost by Municipality Size) ----------	44
10.3	Infrastructure Needs (Per Capita Cost by Region) --------	44
11.1	Impediments to Infrastructure Solutions (Percent of Population Responses)----------	46
11.2	Impediments to Infrastructure Solutions (Population Weighted Responses) ----------	46
12.1	Roads (Per Capita Expenditures) ----------	49
12.2	Roads (Number of Events) ----------	50

Page

13.1 Water Distribution Systems (Per Capita Expenditures) ---- 52

13.2 Water Distribution Systems (Number of Events) ---------- 52

14.1 Sewage Collection Systems (Per Capita Expenditures) ------ 54

14.2 Sewage Collection Systems (Number of Events) ---------- 55

15.1 Canada: Infrastructure Condition ---------- 57
(Percent of Municipalities Responding)

15.2 NLC-USCM: Infrastructure Condition ---------- 57
(Percent of Municipalities Responding)

16.1 Canada: Budget Priority ---------- 59
(Percent of Municipalities Responding)

16.2 NLC-USCM: Budget Priority ---------- 59
(Percent of Municipalities Responding)

17.1 Canada: Priority vs Condition ---------- 61
(Percent of Municipalities Responding)

17.2 NLC-USCM: Priority vs Condition ---------- 61
(Percent of Municipalities Responding)

18. Average Annual Levels of Federal Funding ---------- 65
for Municipal Infrastructure in 1983
Dollars (using Consumer Price Index)

LIST OF TABLES

		Page
1.	Summary of Survey Response	23
2.1	Summary of Condition of Infrastructure (Percent of Respondents)	27
2.2	Summary of Condition of Infrastructure (Population Weighted Percent Response)	28
3.1	Per Capita Municipal Budgets (in $ of year)	35
3.2	Debt Charges	35
4.1	Source of Revenue (Percent of Communities Responding)	39
4.2	Source of Revenue (Percent of Population Responding)	39
5.1	Summary of Costs to Bring Facilities up to an Acceptable Level (Millions of $)	42
5.2	Summary of Costs to bring Facilities up to an Acceptable Level (Dollars per Capita)	43
6.1	Impediments to Infrastructure Solutions (Percent of Communities Responding)	45
6.2	Impediments to Infrastructure Solutions (Percent of Population Responding)	45
7.	Roads (Per Capita Expenditures)	48
8.	Water Distribution System (Per Capita Expenditures)	51
9.	Sewage Collection System (Per Capita Expenditures)	53

I. EXECUTIVE SUMMARY

INTRODUCTION

Public works facilities such as sewer, water, street systems, bridges, parks, community centres and theatres are collectively referred to as urban infrastructure. These facilities are important to the functioning of urban areas and some forms of infrastructure such as sewer, water, roads and bridges are essential to the very existence of urban areas. Without adequate sewer and water systems, sanitation and disease control are impossible in larger cities. Without adequate road and bridge sytems, necessary travel for work, business and other purposes is impeded, delivery of goods is made inefficient and police and fire control are very difficult.

A direct relationship exists between the condition of urban infrastructure and the economic health of the urban area. Industry and commerce in urban areas cannot be efficient without good urban infrastructure. Clearly, it is important not only to provide adequate infrastructure to meet increasing needs but also, once it has been provided, to maintain it adequately and to replace it when it is worn out.

THE PROBLEM

In the last few decades, Canada has undergone rapid urbanization. This has necessitated a significant expansion of urban infrastructure and much of it was provided in a short period of time. It will reach the end of its life in a similarly compressed time. Until the 1970's, the maintenance of these facilities was acceptable, partly because of good economic conditions in Canada and partly because so many facilities were new. In the 1970's, high inflation and rapidly growing costs resulted in increasing resistance by taxpayers to rising taxes. At the same time, a growing array of new services designed to improve the quality of life was provided by government, adding to the tax burden.

High interest rates in the late 1970's and early 1980's resulted in a growing reluctance to borrow money which placed a severe load on direct revenue taxation. In addition, growing environmental concerns and increasing public involvement have made reconstruction more difficult and more expensive. The recent recession has compounded the problem.

Although the primary financial responsibility for urban infrastructure has been that of the local governments, Provincial and Federal Government funding has in the past assisted with managing the burden. In recent years, Federal programs have been severely cut and Provincial programs are also currently subject to severe restraint. Thus, the burden on local governments has been increased.

A combination of these factors and others has resulted in a deferral of necessary work on infrastructure and a growing backlog of maintenance and replacement work.

EFFECTS OF INADEQUATE INFRASTRUCTURE

The most pressing concern is that, if the backlog of necessary work on the maintenance, repair and replacement of Canadian urban infrastructure is permitted to grow, a point may be reached where unreasonably high financing will be required to bring the infrastructure up to acceptable levels. Increasing congestion due to inadequate infrastructure wastes expensive fuel, increases

accidents and creates a significant drain on our economy. The efficiency and competitiveness of industry and commerce in our urban areas are dependent on adequate infrastructure. Under congested conditions, trucking and goods movement can become very expensive. Industry and commerce are also dependent on proper water supply and sewerage services. Thus, significant losses to our society are resulting from inadequate infrastructure.

Another economic loss is that resulting from the current high unemployment in Canada. Highly labour intensive works on urban infrastructure could not only usefully employ many people but, at the same time, reconstruct our essential infrastructure. The combination of the foregoing can contribute to the economic recovery of Canada.

PUBLIC AWARENESS

The problem outlined above is of international scope. In the U.S.A., there has been very considerable media coverage of the problem. A large number of studies have identified the extent of the problem, its causes and, more recently, possible solutions. Much has been learned from these studies and this information is contained in the main report. Since there are many similarities between Canadian and American cities, it is useful to note what was learned in these studies. The U.S. reports describe a deteriorating infrastructure in virtually all areas studied. Reasons identified are similar to those described above. The U.S. studies have identified roads and sidewalks as being in the greatest need of repair (about 70% of responses) and parks, recreational and community social facilities as being in relatively good condition (about 60% of responses). Other types of infrastructure fall between these extremes. A general conclusion of the studies is that responsibility for urban infrastructure must continue to be largely that of local government. However, assistance from other levels of government is required to return the infrastructure to acceptable condition.

Not only has the problem been clearly identified in the U.S.A., but remedial measures are already underway. A bill has been approved by President Reagan providing for highway user charges, the proceeds of which will be ear-marked for highway repair and replacement. Various other bills are either being considered or drafted by committees such as the House Public Works Subcommittee on Economic Development. These bills are designed to provide loans and grants to communities which are unable to cope with the problem themselves. This process has been underway for about two years.

In Canada, there is relatively less public awareness of the problem. Although one of the studies noted above was an international study and did include Canadian cities and the Chairman of the Technical Committee which is producing this current Canadian report was a member of the international task force which produced the report "Revenue Shortfall" and also participated in the European seminar on infrastructure problems, there has been less involvement of Canadian officials in infrastructure research. The Canadian Construction Association has carried out studies on infrastructure deficiencies in some rural areas and published reports on these. To date, however, there has not been a national study in Canada comparable with those in the U.S.A. Our understanding of the problem has, therefore, been incomplete and public awareness considerably less than in the U.S.A.

FEDERATION OF CANADIAN MUNICIPALITIES TASK FORCE ON INFRASTRUCTURE

In 1983, the FCM recognized that an infrastructure problem existed in Canada and established a Canadian Task Force, Chaired by Mayor M. Harcourt of Vancouver, to deal with the matter. The purpose of the Task Force was to ascertain the physical status of urban infrastructure, to determine funding adequacy, to develop policies to correct any inadequacies, and to outline programs which would correct the problem. Detailed terms of reference are set out in the main report.

To assist the Task Force (a political body comprised of elected officials), a Technical Committee of senior technical officials responsible for urban infrastructure in Canadian municipalities has been formed. This technical Committee is listed on the inside front cover (W.H. Curtis, Chairman). Membership has been made up of one from Maritimes, two from Quebec, two from Ontario, and one each from the western provinces. Three of the members are from smaller municipalities. Also represented on the Committee are members from the Federation of Canadian Municipalities and the University of Toronto. The Technical Committee reviewed other studies and decided that a Canadian survey and analysis of the findings were necessary to assist in defining the Canadian problem concisely.

THE CANADIAN STUDY

This report describes Phase I of a Canadian Urban Infrastructure Study covering FCM members, other municipalities and provincial and federal departments involved in urban infrastructure. It describes the Canadian survey, it defines the problems, suggests causes and suggests what must be done to correct the problems. Phase I was carried out between January and May of 1984 and will be presented to the Annual FCM meeting in Winnipeg in June, 1984. Of necessity, it is a preliminary assessment only.

Phase II, assuming the FCM decides to proceed further, will recommend specific policies and begin the difficult task of establishing actual programs, in cooperation with all levels of government, to bring the physical infrastructure back to acceptable levels. It will also refine some of the information necessary to determine costs of reconstructing the infrastructure. The Phase II report should be completed in time for the 1985 Annual FCM meeting, if an early start is made after the 1984 FCM meeting.

LIMITATIONS OF THE STUDY

There are many forms of urban infrastructure. Such facilities as roads, bridges, sewer and water systems, parks and mass transportation are generally termed physical infrastructure. Public health, education, fire safety, and other functions of this type are termed social infrastructure. The American studies have concentrated almost entirely on the physical infrastructure and particularly on sewer, water, roads and bridges as these are in the greatest need of attention. These forms are also essential to the survival of urban areas. Surveys have shown that other forms of infrastructure, although very important to livability of urban areas, have not deteriorated to the same degree. For these reasons, emphasis has been placed on correcting the most critical problems first.

The Canadian study has determined the relative condition of most forms of infrastructure, including physical and social forms. The Canadian results are very similar to those from other studies - roads, bridges, sewer and water

systems are in the greatest need of attention. This Canadian study has also determined costs to repair and replace to adequate levels the sewer, water, road and bridge forms of infrastructure. It was not possible to do this for the other forms and this constitutes a limitation of this study.

Another limitation is that only urban infrastructure has been examined. Other studies are in the process of looking at rural municipal, provincial and federal infrastructure which are beyond the scope of this study as are transit and communications. There is a separate FCM Task Force on transit and on social services.

RESULTS AND CONCLUSIONS OF THE CANADIAN STUDY

Survey Response

Two surveys were conducted in the past few months. The first, a pre-survey of Mayors was conducted to determine whether they felt a problem existed and, if so, whether they would participate in a study. Questionnaires were sent to 245 FCM Mayors. 47 of these responded. A large majority of the respondents felt a problem existed and that their municipalities would participate. Most respondents felt that funding was inadequate to meet their needs and grants from other levels of government were required to make up the shortfall. The Mayors also identified roads as being the urban infrastructure most in need of attention, followed by sewers. Generally, the results correspond to those received in the national survey described below.

A national survey was then make of all FCM municipalities, some other municipalities as well as provincial ministries responsible for urban infrastructure in some areas. The questionnaires were directed, this time, to City Managers who, in turn, circulated the questionnaires to appropriate levels. From a sample of 235 municipal areas, 80 responses have been received. Others continue to come in and it is probable the response would have been better if time allotted had not, of necessity, been so short. The response is excellent for cities over 400,000 population as nearly all are represented. The response in the 100,000 to 400,000 population group of over 64% is good. For the group below 100,000 population, the response is less favourable being 17% of the sample. The results from municipalities of under 10,000 population are not presented in this report because of the low response rate (10%) and because they are rural in nature and have different problems. A separate addendum is available on the results from small communities.

Within the responses, not all questions were answered and, therefore, some questions are supported by less data than others. More information on validity of results is contained in the main report. In general, the Technical Committee has concluded that the data can be considered adequate for the generalized purposes required for this report.

Condition of Canadian Urban Infrastructure

The majority of survey responses indicate that an infrastructure problem exists in Canadian urban areas. This supports the conclusions of the Mayors' pre-survey. Different types of infrastructure are in different states of adequacy. This is illustrated in Diagram 1.

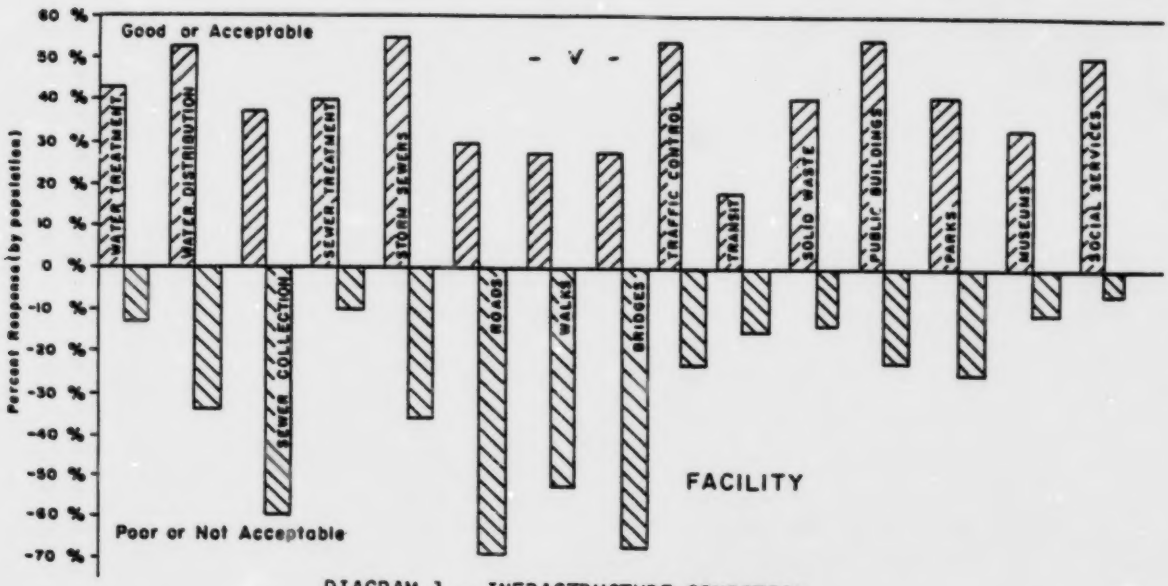


DIAGRAM 1 - INFRASTRUCTURE CONDITION

As with the Mayors' pre-survey, roads are identified as being in the greatest need of attention by 70% of respondents. Sidewalks, bridges and sanitary sewage collection systems are also identified as problem areas by the majority of respondents. More than half of respondents felt public buildings, water distribution sytems, traffic control facilities and storm sewer systems were in good or acceptable condition and the majority of respondents felt parks, solid waste facilities, water treatment systems and social service facilities such as day-care centres were in good or acceptable condition. It should be noted that Diagram 1 pertains to condition of existing facilities. The survey did not attempt to determine whether there was a need for more roads or more social service facilities.

For the essential sewer, water, roads and bridge facilities only, the survey provided information as to what funding is required to bring these facilities up to acceptable condition levels. $598 per capita is required on the average. If a rebuilding program of 10 years is assumed, $60 per capita would be required each year for 10 years. This compares to a 1983 average per capita capital expenditure on public works of $99 per year and an operating expenditure of $137 per year. Thus, a very significant expenditure increase would have to be made over the 10 year period to bring these facilities up to acceptable levels. It is noted that over this 10 year period there will be deterioration of facilities which are now in acceptable condition and even further funding may be required for upgrading.

Diagram 2 shows the required expenditures for the various types of facilities surveyed. Again, by far the greatest need is in the roads category with $249 of the $598 per capita being required for this purpose. To help ascertain the urgency of developing problems, the survey requested information on trends. In this regard, roads, and walks were again identified as the forms of infrastructure which are deteriorating in most

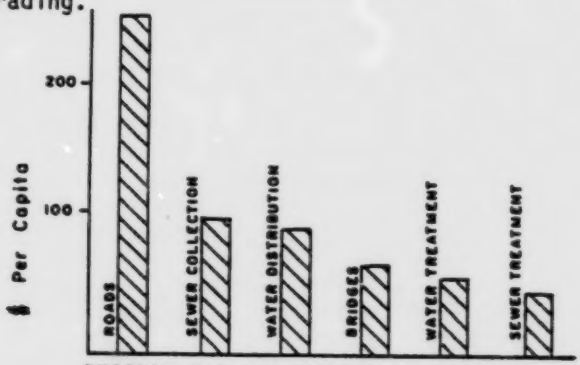


DIAGRAM 2-$ PER CAPITA TO CORRECT

municipalities. About half of the respondents indicated that water distribution and sewer systems were improving in condition and a majority of respondents felt bridges, traffic control facilities, transit, solid waste facilities, public buildings, theatres, museums, libraries, day-care centres, etc. were improving in condition.

The survey also requested information for the years 1968, 1976 and 1983 on claims and on emergency repairs. In this regard, survey results do not establish a trend in claims. The number of emergency repairs in the roads and water categories have increased in this time period. Road emergency repairs are rising the most rapidly. Water system breaks are rising at a lower rate.

The results of the condition survey are comparable with those obtained in the U.S. surveys and also with the Canadian Mayors' pre-survey. They indicate that a significant problem with urban infrastructure exists in Canada and that there is a revenue shortfall to correct the situation which will be difficult to overcome. The condition of facilities in the poorest categories is deteriorating most rapidly.

Funding

The major responsibility for funding urban infrastructure work is that of local government. User fees provided most of the funding required for water systems and sewage treatment (about 80%). General tax revenues are the largest source of funding for roads (about 60%) and bridges (about 50%). Provincial funding for roads and bridges is the second largest source, providing approximately one-quarter of the funding. Survey results show that Federal funding is almost non- existent except for bridges (about 5%) (see Diagram 3).

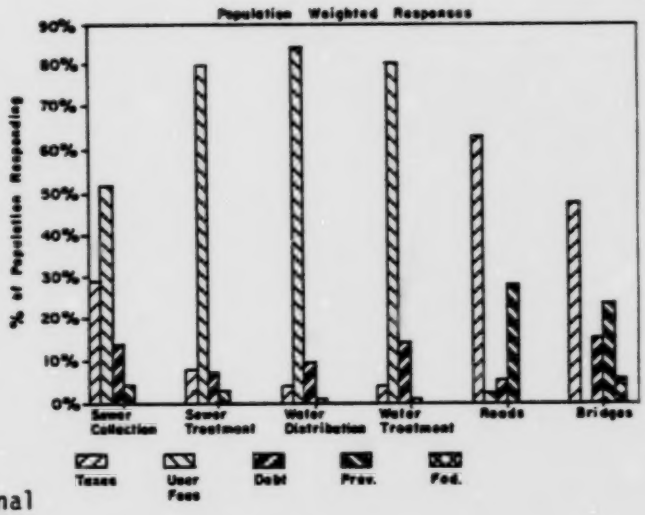


DIAGRAM 3-SOURCES OF REVENUE

The Mayors' pre-survey indicates that funding is inadequate. The national survey supports this conclusion and shows that the degree of underfunding in such areas as roads, bridges, sewer and water facilities is significant. The survey shows that, in the period 1968 to 1983, there has been a decrease in public works budgets on a per capita basis in terms of constant dollars when an increase was necessary to cope with growing need resulting from rising emergency repairs and aging of the facilities.

The Technical Committee has found that in the western and eastern regions of Canada, there is a growing trend towards "pay-as-you-go" financing. This trend began during periods of very high interest rates when borrowing was very unattractive. Under today's restraint conditions, there is still a tendency in these areas to avoid borrowing. In Ontario and most of the prairies, pay-as-you-go has not been a problem. When borrowing is curtailed, additional load is placed on direct taxation. In view of current extreme restraints, insufficient funding is being provided from direct taxation to meet

infrastructure requirements. There exist in Canada limitations to the amount of borrowing permitted as a proportion of total budgets. The Technical Committee has found that this limitation is not a problem in most regions of Canada (in the U.S., these restrictions are a significant problem). The Mayors' pre-survey indicated that in all parts of Canada there is a general tendency at the political level to "pay-as-you-go". The Technical Committee concluded that, if this trend persists and if borrowing is further restricted, it will be very difficult to cope with the rising backlog of infrastructure work.

In summary, funding at the local government level has not been sufficient to provide for necessary infrastructure work. As a result, a backlog of such work is growing and additional funding will have to be provided if this trend is to be halted and remedial measures carried out.

The Technical Committee reviewed the possibility of increasing user charges as a source of funding. It concluded that the possibility existed of increasing user charges in the sewerage, roads and bridges areas. With roads and bridges, this could mean additional taxes on fuel or tolls - both of which are highly unpopular with the public. There is concern with regard to inequity because the direct users of a public works system are not its only beneficiaries as noted in California. Perhaps local improvement procedures, which provide for a portion of the cost being paid by those benefiting, are the most appropriate mechanism for increasing user charges in these areas. Of course, the local government's share of local improvement costs will have to be raised by the local governments.

Federal Government funding programs have been declining over the past 15 years. There has been a tendency to emphasize new construction because Federal programs have largely been geared towards reducing unemployment. Additional employment has been equated to new works rather than maintenance and reconstruction works - presumably because maintenance of existing infrastructure is an ongoing function and new jobs would not result. With significant layoffs of local government staff in various parts of Canada, this is no longer the case and Federal funding for maintenance and replacement could create additional jobs.

Another problem with Federal programs which the Technical Committee identified was the large number of restrictions and conditions which had to be met - again largely for employment creation reasons. These restrictions have tended to make work under these programs less efficient and more expensive. If Federal programs were to be created to deal with the infrastructure problem at this time, regulations should be altered to make them more effective.

In recent years, the Federal programs have been significantly reduced to the point where Federal assistance for infrastructure work is now very limited. Even though Federal contributions were never very large in relation to local government contributions towards infrastructure work, the reduction of Federal programs, when added to the inadequacy of local government funding, has resulted in a worsening of the revenue shortfall situation. In the U.S.A., remedial measures currently being implemented involve Federal government participation. Significant steps in this direction have already been taken and others are in preparation. The Technical Committee has found that similar steps are required in Canada to assist local government in solving the infrastructure problem. The Committee recognizes that intergovernmental relations in Canada between the Federal, Provincial and local government levels are different and this will have to be recognized in establishing cooperative programs between the three levels of government for the purpose of dealing with revenue shortfall.

Causes of Infrastructure Decline

The survey lists five causes of infrastructure decline and provides for others. Results are as shown in Diagram 4. As expected funding shortage was identified as the leading cause by over 90% of respondents. Delays and cost increases resulting from excessive public involvement, red tape and political inaction are very significant factors as well and these are increasing. The Technical Committee, in reviewing the causes of decline, recognized that growing environmental and increasing local area concerns must be accommodated. Some suggestions for improvement in this regard are that public involvement be incorporated early in the process, and that officials become more skilled in dealing with these impediments.

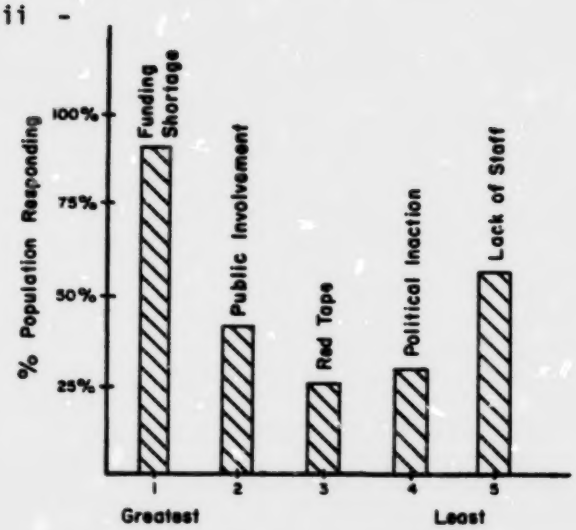


DIAGRAM 4-DEGREE OF IMPEDIMENT

Although lack of staff for problem analysis was identified as the least significant cause, the Technical Committee concluded from the survey response that it was a significant problem, particularly in smaller municipalities. It was apparent that the lower survey response from the smaller municipalities was due to inadequate information retrieval systems and inability to analyze available information. The Committee concluded that improved management systems would be one objective which could assist in coping with the infrastructure problem. To this end, the Committee concluded that increased interaction of officials in Canada was desirable - perhaps through strengthened national associations.

Comparison with the U.S. and Europe

This study shows that Canadian urban areas are faced with similar problems to those identified in U.S. studies. The revenue shortfall at the local government level is perhaps somewhat less than in the U.S.A. but, on the other hand, the decrease in Federal assistance is more severe. Studies in both the U.S.A. and Canada have identified roads as having the greatest need of attention. There are similarities for most other types of infrastructure. The U.S. has recognized the problem sooner and are already beginning to deal with it. There is considerably greater public awareness of the problem in the U.S. and legislation to increase funding for infrastructure work has already been passed or is in the process. Some of the solutions being implemented in the U.S., such as Federal government funding programs to assist municipalities in difficulty, would be applicable in Canada. In both countries, it is clear that local governments need additional revenue sources and assistance in order to cope with the backlog of work and prevent further deterioration of the infrastructure.

In the spring of 1984 the American Public Works Association, the U.S. National League of Cities and the Federation of Canadian Municipalities sponsored a series of seminars on urban infrastructure in various European cities. These have shown that existing European urban infrastructure is in relatively acceptable condition with some exceptions. Sewer and waterworks are financed largely from user charges which until recently have been adequate. Central governments are very significantly involved in urban infrastructure works through grants and cost sharing arrangements with local governments. One price of this greater central government funding is considerably less autonomy of local government in priority setting and decision making.

Recently, European central governments have begun to control user rates and restrict grants. Local government funding is inadequate and maintenance and replacement works are now being deferred. A backlog of work is starting to build up in urban areas but this is not serious yet.

In an effort to reduce the burden on government, there is a trend towards privatization. In England private housing is increasing dramatically. Similar changes are occuring in France and Germany. Some European municipalities use "innovative" financing methods. One of these is municipal involvement in private enterprises such as banks and mines. Profits from these are used to offset deficits in government functions. The appendix contains further information on the European situation.

In both Europe and the USA work is in progess on setting service level standards. Canada should join in this effort.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of previous studies, comparisons with the US and European Countries, its own experience, and the survey results outlined in this report, the Technical Committee on Canadian Urban Infrastructure has reached the following conclusions and makes the following recommendations:

1) A significant decline has occurred in the condition of infrastructure in Canadian urban areas. Steps should be taken to halt that trend.

2) The costs to bring the most seriously deteriorated forms of infrastructure (sewer, water, road and bridge systems) back to acceptable levels are high. Even when spread over a 10 year recovery period, these costs will represent an increase in current public works budgets of about 25%.

3) Additional local government funding sources should be found to help solve the revenue shortfall problem identified.

4) To raise the required funding is beyond the ability of many local governments and some assistance from other levels of government is required.

5) Better information systems should be developed, particularly in smaller municipalities, to permit better management of infrastructure systems and more effective use of available funding. Lack of information was a frequent reason given for not completing the survey questionnaire.

6) Greater interchange of information between Canadian municipal officials should be achieved through strengthened national associations and the publication of manuals on management practices.

7) To achieve a greater degree of national consistency in levels of infrastructure service, work should begin on the setting of service standards. This should be done in concert with the USA and European countries who are currently working on these. This is a long term effort and rebuilding of infrastructure should not await its completion.

8) Methods should be investigated which would reduce waste and excess costs due to delays and other impediments to reconstruction and maintenance of infrastructure.

9) Without jeopardizing the provision of new facilities needed to meet growth, a greater emphasis should be placed on maintenance and reconstruction as opposed to new construction, especially in Federal programs which might be developed in the future. This would extend the life of existing facilities.

10) Local governments should re-examine priorities so that the most essential basic services are emphasized during times of severe restraint. If this is not done, the economic health of our urban areas may be jeopardized and, with it, the other services as well.

11) Policies should be set by the FCM which could form the foundation and guidelines for recovery. The FCM should direct its Task Force on Urban Infrastructure, through its Technical Committee, to outline specific policies.

12) Programs should be established to begin implementing these policies and to deal with the reconstruction of the deteriorated forms of infrastructure over the next 10 year period.

13) An intergovernmental partnership should be established which would bring the combined and cooperative efforts of the three levels of government to the solution of the infrastructure problem. The opportunity exists to reconstruct our urban infrastructure, to make our urban areas more competitive, to strengthen Canada's economic recovery and, at the same time, to employ large numbers of Canadians in these labour intensive works.

14) National priorities may need adjustment to recognize that Canada is becoming an increasingly urbanized nation. It is in our urban areas that most Canadians live and it is here that our greatest problems are developing.

15) Public awareness of the infrastructure problem should be increased to obtain public support for necessary remedial measures through the wide dissemination of this report and other means available to the FCM.

16) The FCM should direct its Task Force, through its Technical Committee, to proceed with Phase II of this study in order to crystallize policies and outline programs necessary for corrective action in cooperation with other levels of government where necessary.

17) Estimated costs of Phase II are $50,000. Funding should be provided for this purpose.

RECAPITULATION GENERALE

INTRODUCTION

On désigne par infrastructure urbaine l'ensemble des installations de travaux publics comme les égoûts, l'eau, les réseaux de chausées, les ponts, les parcs, les centres communautaires et les théâtres. Ces installations jouent un rôle important dans le fonctionnement des zones urbaines, et certaines formes de l'infrastructure telles les égoûts, l'eau, les chaussées et les ponts sont essentielles à l'existence des zones urbaines. Sans équipement adéquat sur le plan des égoûts et de l'eau, l'hygiene publique et le contrôle sanitaire sont impossibles dans les plus grandes villes. Sans un réseau adéquat de chaussées et de ponts, les déplacements obligatoires pour le travail, les affaires, ou d'autres activités sont entravés, la livraison des marchandises devient inefficace et le contrôle policier ou la maîtrise des incendies s'avèrent tres difficiles.

Il existe un rapport direct entre les conditions de l'infrastructure urbaine et la santé de l'économie d'une zone urbaine. L'industrie et le commerce urbains ne peuvent pas être d'un bon rendement sans bonne infrastructure urbaine. Evidemment, il est important non seulement d'offrir une infrastructure adéquate à la rencontre de besoins croissants, mais aussi, une fois que cette infrastructure est offerte, de la maintenir en bon état et de la remplacer lorsqu'elle ne convient plus.

LE PROBLEME

Au cours des récentes décennies, le Canada a connu une urbanisation rapide. Ceci a nécessité une expansion considérable de l'infrastructure urbaine dont la plus grande partie a été offerte en un court laps de temps. Cela risque de continuer au même rythme. Jusque dans les années 70, l'entretien de ces installations a suffi, en partie grâce aux bonnes conditions de l'économie canadienne, et aussi grâce a la nouveauté de beaucoup de ces installations. Au cours des années 70, l'inflation élevée et l'augmentation rapide des coûts ont abouti a une résistance croissante de la part des contribuables a la hausse des impôts. En même temps, le gouvernement offrait un ensemble de services nouveaux destinés à améliorer la qualité de la vie, ce qui a alourdi le fardeau des impôts.

Les taux élevés d'intérêts a la fin des années 70 et au début des années 80 a entrainé une répugnance croissante à emprunter de l'argent, ce qui a aggravé sérieusement le fardeau des impôts directs. De plus, les problemes croissants de l'environnement et l'implication de plus en plus marquée du public ont rendu la reconstruction plus difficile et plus onéreuse. Enfin, la récente récession a aggravé le problème.

Bien que la responsabilité financiere premiere de l'infrastructure urbaine appartienne aux gouvernements locaux, les fonds des gouvernements fédéral et provinciaux ont, dans le passé, permis d'alléger le fardeau. Ces dernières années, les programmes du Fédéral ont subi de sérieuses coupures, et ceux des Provinces sont aussi actuellement sujets a de graves restrictions. C'est pourquoi ce sont les gouvernements locaux qui ont vu leur fardeau augmenter. La combinaison de ces facteurs et d'autres a provoqué un ajournement des remaniements nécessaires de l'infrastructure et un arriéré croissant des travaux d'entretien et de remplacement.

CONSEQUENCES D'UNE INFRASTRUCTURE INADEQUATE

Le probleme le plus urgent est que, si l'on permet un accroissement de l'arriéré des travaux nécessaires a l'entretien, la réparation et le remplacement de l'infrastructure canadienne, on risque d'atteindre un point où un financement déraisonnablement élevé sera nécessaire pour que les niveaux de l'infrastructure demeurent acceptables. Une congestion croissante due à une infrastructure inadéquate amène au gaspillage d'un carburant onéreux, augmente le nombre des accidents et engendre une saignée considérable de l'économie. Le bon rendement et la compétitivité du commerce et de l'industrie dans les zones urbaines dépendent d'une infrastructure adéquate. Dans ces conditions de congestion, le camionnage et le transport des marchandises peuvent devenir très chers. L'industrie et le commerce dépendent aussi de services d'alimentation en eau et d'égoûts appropriés. Par conséquent, une infrastructure inadéquate peut aboutir -et aboutit- a des pertes considérables pour notre société.

Une autre perte économique est celle découlant du chômage élevé qui sévit actuellement au Canada. Des travaux qui nécessitent l'emploi d'un grand nombre de personnes sur le plan de l'infrastructure urbaine pourraient donc atteindre deux objectifs utiles: non seulement ils utiliseraient beaucoup de gens mais en même temps aboutiraient à la reconstruction de notre infrastructure essentielle. La combinaison de ce qui précède peut contribuer au redressement économique du Canada.

PRISE DE CONSCIENCE DU PUBLIC

Le probleme souligné est d' envergure internationale. Aux U.S.A. la presse a énormément traité la question. Un grand nombre d'études ont établi l'ampleur du problème, ses causes et, plus récemment proposé, d'éventuelles solutions. On a beaucoup appris de ces études et le rapport principal contient ces renseignements. Puisqu'il existe beaucoup de similitudes entre les villes canadiennes et américaines, il est utile de noter ce que l'on a retenu de ces études. Les enquêtes américaines révelent une infrastructure en voie de détérioration dans pratiquement tous les domaines d'études. Les raisons établies sont semblables a celles décrites ci-dessus. Les études américaines ont établi que les chaussées et les trottoirs avaient le plus grand besoin de réfections (environ 70% des réponses) et que les parcs, les équipements de loisirs et de vie communautaire étaient en relativement bonnes conditions (environ 60% des réponses). Les autres types d'infrastructure se situent entre ces extrêmes. La conclusion générale de ces études est que la responsabilité de l'infrastructure urbaine doit grandement continuer d'incomber aux gouvernements locaux. Cependant, une aide d'autres niveaux des gouvernements est nécessaire pour que l'infrastructure revienne a une condition acceptable.

Non seulement on a clairement identifié le probleme aux U.S.A., mais des mesures de redressement sont déja en cours. Le Président Reagan a ratifié une loi prévoyant des droits de péage pour les usagers des autoroutes, dont le produit sera affecté a la réparation et au remplacement des autoroutes. Diverses autres lois sont soit envisagées, soit ébauchées par des comités comme le sous-comité du Ministere des Travaux Publics au développement économique. Ces lois sont élaborées afin de fournir des prêts et des subventions aux communautés qui sont incapables d'affronter elles-mêmes les problèmes. Ce processus est en cours depuis environ deux ans.

Au Canada, le public est relativement moins conscient du problème. Une des études mentionnées ci-dessus était une étude internationale et comprenait des villes canadiennes. Le président du Comité Technique qui a fourni ce rapport

canadien actuel était membre du comité spécial internation qui a fourni le rapport intitulé "Revenue Shortfall" (manque de revenus) et a également participé au séminaire européen sur les problèmes d'infrastructure au printemps de 1984. De plus, l'Association Canadienne de la Construction a effectué des études sur les faiblesses de l'infrastructure en zone rurale et publié des rapports là-dessus. Cependant, il n'y a pas eu jusqu'à présent au Canada d'enquête nationale qui soit comparable à celles effectuées aux U.S.A. Notre compréhension du problème a donc été incomplète et la prise de conscience du public beaucoup moins aigüe qu'aux U.S.A..

FEDERATION DES COMITES SPECIAUX DES MUNICIPALITES CANADIENNES SUR L'INFRASTRUCTURE

En 1983, la FCM reconnaissait qu'un problème d'infrastructure existait au Canada et constituait un Comité Spécial Canadien, présidé par le maire de Vancouver, Mr. Harcourt, pour venir a bout du probleme. Le but de ce comité était d'établir le statut physique de l'infrastructure urbaine de déterminer le montant des fonds nécessaires, de mettre au point des politiques pour corriger certaines insuffisances et d'ébaucher des programmes qui corrigeraient le problème. Le détail de ces informations est indiqué dans le rapport principal.

Pour aider le Comité Spécial (un corps politique comprenant des fonctionnaires élus) on a formé un Comité Technique de fonctionnaires techniques supérieurs responsables de l'infrastructure urbaine dans les municipalités canadiennes. La liste des membres de ce Comité Technique figure en page 2 de la couverture du rapport (Président: W. H. Curtis) . Les membres sont ainsi répartis: un des Provinces Maritimes, 2 du Québec, 2 de l'Ontario, et 1 des Provinces de l'Ouest. Trois de membres proviennent de petites municipalités. Sont également représentés au Comité des membres de la FCM et de l'Université de Toronto. Le Comité Technique a examiné d'autres études et décidé qu'une enquête canadienne et une analyse des découvertes étaient nécessaires pour aider a cerner le problème canadien de facon concise.

L'ETUDE CANADIENNE

Ce rapport décrit la phase I d'une étude sur l'infrastructure urbaine au Canada, englobant les membres de la FCM, d'autres municipalities et des ministères provinciaux et fédéraux impliqués dans l'infrastructure urbaine. Il décrit l'enquête canadienne, définit les problèmes suggère des causes et ce qui doit être fait pour corriger les problèmes. La phase I a été effectuée entre janvier et mai 1984 et sera présentée à l'assemblée annuelle de la FCM qui se tiendra à Winnipeg, en juin 1984. Bien sûr, il ne s'agit que d'un jugement préliminaire. La phase II, en admettant que la FCM décide de continuer, recommandera des politiques précises et entreprendra la tâche difficile d'établir des programmes concrets, en coopération avec tous les niveaux de gouvernement pour ramener l'infrastructure physique a des niveaux acceptables. Elle triera certains des renseignements nécessaires à la détermination des coûts de reconstruction de l'infrastructure. Le rapport de la phase II devrait être terminé pour l'assemblée annuelle de la FCM de 1985, si elle est commencée dès après l'assemblée de 1984.

LIMITES DE L'ETUDE

Il existe beaucoup de formes de l'infrastructure urbaine. On nomme généralement infrastructure physique les installations comme les chaussées, les ponts, les égoûts et les conduites d'eau, les parcs et les transports en commun. On appelle infrastructure sociale l'ensemble des installations concernant la santé

publique, l'education, la protection contre l'incendie et les autres fonctions de ce genre. Les études américaines se sont presqu'entièrement consacrées à l'infrastructure physique et plus particulièrement aux égoûts, a l'eau, aux ponts et chaussées du fait que ces réseaux nécessitent la plus grande attention. Ils sont également essentiels à la survie des zones urbaines. Les enquêtes ont révélé que les autres formes de l'infrastructure, bien que très importantes pour la viabilité des zones urbaines, ne se sont pas détériorées au même point. Pour ces raisons on a d'abord mis l'accent sur la correction des problèmes les plus critiques.

L'étude canadienne a déterminé les conditions relatives de la plupart des formes d'infrastructure y comprises les formes physiques et sociales. Les résultats obtenus au Canada sont très semblables à ceux des autres études -chausséees, ponts, égoûts et eau nécessitent la plus grande attention. Cette étude canadienne a aussi déterminé les coûts de réparation et de remplacement aux niveaux appropriés des formes de l'infrastructure concernant les égoûts, l'eau, les chaussées et les ponts. Il n'a pas été possible de le faire pour les autres formes et cela constitue une limite à cette étude. Une autre est que seule l'infrastructure urbaine a été examinée. D'autres études sont actuellement effectuées sur l'infrastructure au plan rural municipal, provincial et fédéral, lesquelles dépassent le but de cette étude, comme celles faites sur le transit et les communications. Il existe d'ailleurs un Comité Spécial de la FCM sur le transit et les services sociaux.

RESULTATS ET CONCLUSIONS DE L'ETUDE CANADIENNE

Réponses aux enquêtes

Deux enquêtes ont été menées ces derniers mois. La premiere, une pré-enquête auprès des maires a été menée pour déterminer s'ils avaient l'impression qu'un problème existait et, dans ce cas, s'ils acceptaient de participer à une étude. On an envoyé des questionnaires a 245 maires de la FCM. 43 ont répondu. Une grande majorité d'entre eux ont perçu l'existence d'un problème et ont accepté de participer. La plupart de ceux qui ont répondu estimaient que les fonds ne correspondaient pas a leurs besoins et que les subventions accordées par les autres niveaux de gouvernement étaient nécessaires pour pallier au manque de revenus. Les maires ont également établi que les chaussées étaient la forme d'infrastructure urbaine qui exigeait le plus d'attention, suivies par les égoûts. En général, les résultats correspondent à ceux reçus lors de l'enquête nationale décrite ci-dessous. Une enquête nationale a été effectuée au niveau de toutes les municipalités FCM, d'autres municipalités et de ministères provinciaux responsables de l'infrastructure urbaine dans certaines régions. Cette fois, on a adressé les questionnaires aux administrateurs municipaux qui, à leur tour, les ont fait circuler aux niveaux désirés. A partir d'un sondage touchant 235 municipalités, on a obtenu 80 réponses. Les autres continuent de nous parvenir et il est probable que les réponses eussent été meilleures si le temps imparti pour cela n'avait pas été si court. La réponse est excellente en ce qui concerne les villes de plus de 400 000 habitants puisqu'elles sont presque toutes représentées. La réponse concernant les villes de 100 à 400 000 habitants dépasse 64% et est bonne. Pour le groupe des villes de moins de 100 000 habitants, la réponse, de 17%, est moints favorable. Les résultats en provenance des municipalités de moins de 10 000 habitants ne sont pas présentés dans ce rapport à cause du faible taux de réponses (10%) et parce qu'elles sont de type rural et ont des problèmes diffeérents. On peut se procurer un addendum séparé des résultats provenant des petites communautés.

Quant au contenu des réponses, il n'a pas été répondu à toutes les questions et, par conquent, il existe moins de données pour certaines que pour d'autres. Le rapport principal contient plus de renseignements sur la validité de résultats. En général, le Comité Technique est arrivé à la conclusion que les données peuvent être considérées comme valables étant donnés les objectifs généralisés exigés par ce rapport.

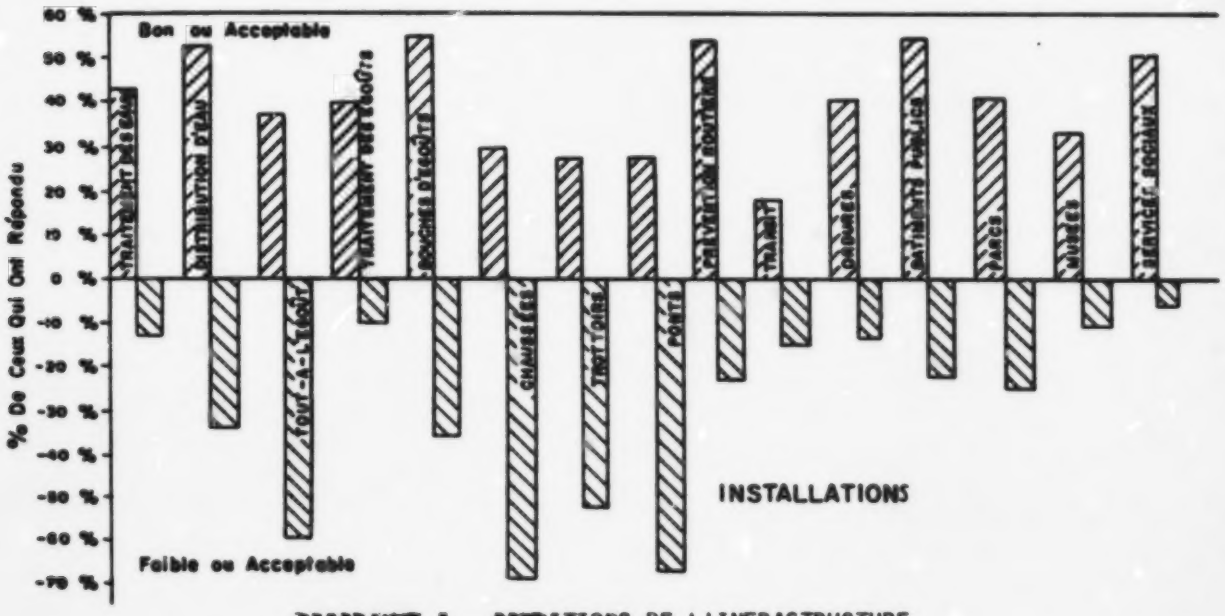


DIAGRAMME I - CONDITIONS DE L'INFRASTRUCTURE

CONDITIONS DE L'INFRASTRUCTURE URBAINE AU CANADA

La majorité des réponses au sondage indique qu'un problème existe dans les zones urbaines du Canada. Ceci appuie les conclusions de la pré-enquête auprès des maires. Divers types d'infrastructure se trouvent en divers états de fonctionnement, tel qu'illustré par le diagramme I.

Comme dans la pré-enquête des maires, 70% de ceux qui ont répondu, ont constaté que les chaussées nécessitaient la plus grande attention. La majorité d'entre eux ont aussi constaté que les trottoirs, les ponts et les égoûts séparatis présentent des problèmes. La moitié estime que les batiments publics, les réseaux de distribution de l'eau, les installations du contrôle routier et les réseaux d'égoûts d'eaux de surface sont en conditions bonnes ou acceptables, et la majorité considère que les parcs, les champs d'épandage, les réseaux de traitement des eaux et les services d'intérêt social comme les garderies d'enfants sont en conditions bonnes ou acceptables. On doit remarquer que le diagramme I se rapporte aux conditions des installations existantes. L'enquête n'a pas essayé de déterminer si l'on avait besoin de plus de chaussées ou de plus d'installations d'intérêts social.

Pour l'essentiel des installations ne concernant que les égoûts, l'eau, les chaussées et les ponts, l'enquête fournit des renseignements comme le montant des sommes requises pour porter ces installations à des niveaux de conditions acceptables. Il faut en moyenne 598 $ par habitant. Si l'on envisage un programme de reconstruction réparti sur 10 ans, chaque habitant devra payer $60 par année. Ceci se compare à la moyenne par habitant en 1983 des principales dépenses consacrées aux travaux publics de $99 par année et à une dépense

opérationnelle de $137 par année. Par conséquent, il faudrait subir une augmentation très considérable des dépenses au cours de 10 années pour amener ces installations à des niveaux acceptables. On remarque qu'au - dela de cette période de 10 ans, il y aura détérioration des installations qui se trouvent actuellement dans des conditions acceptables et il se peut qu'on ait besoin de fonds supplémentaires pour les remettre en bon état.

Le diagramme 2 indique les dépenses exigées pour les divers types d'installations examinées. A nouveau, c'est la catégorie des chaussées qui nécessite, et de loin, la plus grande attention avec $249 des $598 par habitant requis dans ce but.

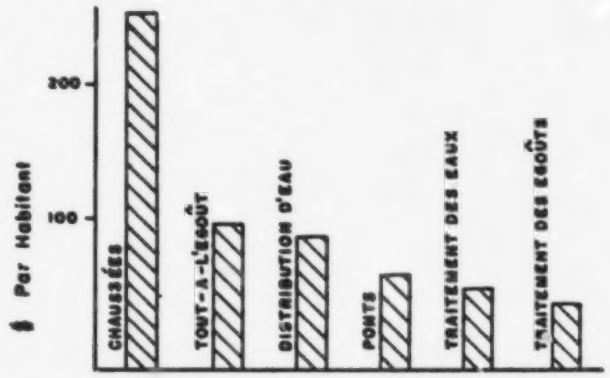


DIAGRAMME 2 - CORRECTION EN $ PAR HABITANT

Afin de vérifier sérieusement l'urgence des problèmes qui se posent, l'enquête s'est intéressée aux tendances. A cet égard, on estime à nouveau que les chausseés et les trottoirs sont les formes d'infrastructure qui se détériorent dans la plupart des municipalités. Environ la moitié de ceux qui ont répondu ont indiqué que les conditions des systèmes de distribution d'eau et des égoûts s'améliorent, de même que, pour la majorité d'entre eux, celle des ponts, des installations de contrôle routier, de transit, des champs d'épandage, des bâtiments publics, des théâtres, des musées, des bibliothèques, des garderies etc...

L'enquête s'est également intéressée aux réclamations et aux réparations d'urgence faites en 1968, 1976 et 1983. Au cours de cette période, le nombre de réparations d'urgence, en ce qui concerne les chaussées et l'eau, a augmenté. Ce sont les réparations d'urgence des chaussées qui augmentent le plus rapidement. Les ruptures des conduites d'eau augmentent à un taux moins élevé.

Les résultats de l'enquête sur les conditions sont comparables à ceux obtenus aux U.S.A., de même que dans la pré-enquête canadienne des maires. Ils montrent qu'il existe un grave problème au niveau de l'infrastructure urbaine au Canada et que l'on manque de fonds pour corriger la situation qui sera difficile à surmonter. Les conditions des installations relevant des catégories les plus démunies se détériorent le plus rapidement.

FONDS

C'est le gouvernement local qui détient la plus grande responsabilité des fonds de l'infrastructure urbaine. Les frais payés par les utilisateurs fournissent la majorité des fonds requis par les systèmes de conduites d'eau et de traitement des égoûts (environ 80%). Les impôts généraux sur le revenu forment la principale source de fonds pour les chaussées (environ 60%) et les ponts (environ 50%). La deuxième principale source est le fonds provincial pour les chaussées et les ponts, apportant approximativement un quart du fonds. Les résultats de l'enquête que le fonds fédéral est à peu près nul sauf pour les ponts (env.6%). (voir Diagramme 3).

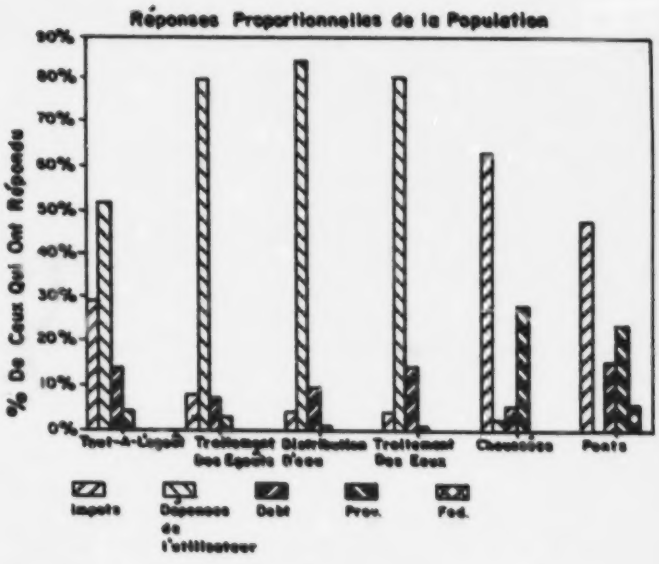


DIAGRAM 3 - SOURCES DE REVENU

La pré-enquête des maires montre que les fonds sont insuffisants. L'enquête nationale appuie cette conclusion et indique que le manque de fonds dans des secteurs comme les chaussées, les ponts, les égoûts et l'eau est considérable. L'enquête montre que, durant la période qui s'étend de 1968 à 1983, il y a eu une diminution par habitant des budgets pour les travaux publics en termes de dollars constants. Néanmoins, il y aurait dû y avoir une augmentation pour répondre aux besoins grandissants dûs à l'urgence accrue des réparations et au vieillissement des installations.

Le Comité Technique a trouvé que dans les régions occidentales et orientales du Canada, il existe une tendance accrue vers le financement "payer à mesure". Cette tendance a commencé au cours des périodes de taux d'intérêts très élevés quand l'emprunt n'attirait personne. Dans les conditions actuelles de restriction, il existe encore dans ces régions une tendance à éviter l'emprunt. En Ontario et dans la majeure partie des Prairies, le "Payer à mesure" n'a pas été un problème. Quand les possibilités d'emprunter sont réduites, on augmente les impôts directs. Etant donnée l'extrême restriction actuelle, l'impôt direct ne fournit qu'un fonds insuffisant pour répondre aux besoins de l'infrastructure. Il existe au Canada des limites au montant des sommes empruntées autorisées en tant que parties de budgets globaux. Le Comité Technique a trouvé que cette restriction n'était pas un problème dans la plupart des régions canadiennes, (aux U.S.A. ces restrictions représentent un problème considérable). La pré-enquête des maires a révélé que partout au Canada, il existe une tendance gé nérale pour une politique de "payer à mesure". Le Comité Technique conclut que, si cette tendance persiste et si les possibilités d'emprunter deviennent de plus en plus réduites, il sera très difficile de faire face à l'arriéré croissant des travaux d'infrastructure.

En résumé, les fonds, au niveau du governement local, ne sont pas suffisants pour répondre aux besoins de l'infrastructure. En consequence, un arriéré de travaux est en train de s'accumuler et il faut trouver des fonds supplémentaires pour que cette tendance puisse etre freinée par des mesures de redressement. Le Comite Technique a examiné la possibilité d'augmenter les depenses de l'utilisateur comme source de fons. Il conclut que cette possibilité a existé dans les secteurs du tout-à-l'égoût, des chaussées et des ponts. En ce qui concerne les ponts et les chaussées, ceci signifierait des impôts supplémentaires sur le carburant ou les péages -déjà très impopulaires auprès du public. Mais il existe un problème d'injustice parce que les utilisateurs directs d'un système de travaux publics n'en sont pas les seuls bénéficiaires comme on l'a remarqué en Californie. Peut-être, des procédures d'amélioration de la part des gouvernements locaux qui fournissent une partie des coûts payés par ceux qui en bénéficient, seraient-elles les plus opportunes pour augmenter les dépenses des utilisateurs dans ces secteurs. Naturellement, le partage par les gouvernements locaux des coûts d'amélioration locaux devra être proposé par les gouvernements locaux.

Les programmes de fonds du governement fédéral sont en baisse depuis les 15 dernières années. On a eu tendance à mettre l'accent sur la nounelle construction, parce que les programmes fédéraux ont dû s'attacher à réduire le chômage. Des emplois supplémentaires ont été assimilés à de nouveaux travaux plutôt qu'à des travaux d'entretien ou de reconstruction - vraisemblablement parce qui l'entretien d'une infrastructure existante est une fonction suivie et qu'il n'en resulterait pas de nouveaux emplois. Avec le nombre considérable de licenciements du personnel des gouvernements locaux dans les diverses régions du Canada ce n'est désormais plus le cas et les fonds federaux pour les travaux d'entretien et de remplacement pourraient créer des emplois supplémentaires.

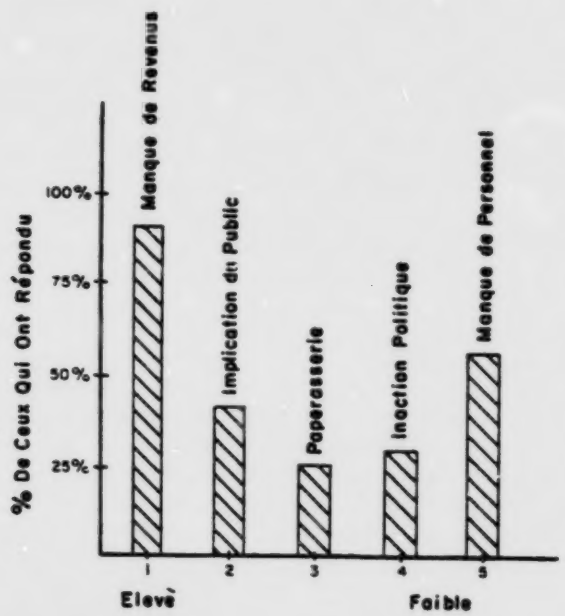
Un autre problème concernant les programmes du Fédéral que le Comité Technique a constaté est le plus grand nombre de restrictions et les conditions rencontrées -encore une fois surtout pour des raisons de création d'emplois. Ces restrictions ont tendu à rendre les travaux liés à ces programmes moins rentables et plus onéreaux. Si les programmes fédéraux devaient être créés maintenant pour résourdre les problèmes de l'infrastructure, il faudrait modifier les règlements afin de les rendre plus efficaces.

Récemment, les programmes fédéraux ont été considérablement réduits au point que désormais l'aide du Fédéral dans le domaine des travaux de l'infrastructure est très limitée. Même si les subventions du Fédéral n'ont jamais été très grandes par rapport à celles des gouvernements locaux, la réduction des programmes fédéraux, quand elle s'ajoute à l'insuffisance des fonds des gouvernements locaux, a abouti à une détérioration de la situation du manque de revenus. Aux U.S.A., des mesures de redressement sont actuellement prises qui engagent la participation du gouvernement fédéral. Des dispositions considérables ont été prises dans cette direction, d'autres sont en préparation. Le Comité Technique a trouvé que des dispositions semblables sont nécessaires au Canada pour aider les governements locaux à résoudre les problèmes de l'infrastructure. Le Comité reconnaît qu'au Canada les lations intergouvernementales entre les niveaux fédéral, provinciaux locaux sont différentes et il faudra le reconnaître lorsqu'on propose des programmes coopératifs entre ces trois niveaux de gouvernement si l'on veut venir à bout du manque de revenus.

CAUSES DES DETERIORATIONS DE L'INFRASTRUCTURE

L'enquête dénombre 5 causes du déclin de l'infrastructure. Les résultats sont indiqués sur le diagramme 4. Comme on s'y attendait, plus de 90% de ceux qui ont répondu ont identifié le manque de fonds comme principale cause. Les délais et les augmentations de coûts dûs à une implication publique excessive, la paperasserie et l'inaction politique sont autant de facteurs significatifs qui ne cessent de prendre de l'ampleur. Le Comité Technique, en examinant les causes de cette détérioration reconnaît qu'il faut s'adapter à l'importance grandissante de l'environnement et des problèmes d'intérêt local. A cet égard, quelques suggestions d'amélioration sont que l'implication du public devrait être incorporée tôt au processus et les fontionnaires mieux préparés à traiter les problèmes.

DIAGRAMME 4
IMPORTANCE DU PROBLEME



Bien que l'enquête ait révélé que le manque de personnel capable d'analyser ces problèmes était la 5ème cause, le Comité Technique a conclu des réponses de l'enquête qu'il s'agissait là d'un problème considérable, surtout dans les plus petites municipalités. Il était apparu que le faible nombre de réponses à l'enquête venant des plus petites municipalités était dû à l'incompétence des organisations de recherche documentaire et à l'incapacité d'analyser des renseignements disponibles. Le Comité a conclu à l nécessité d'améliorer la gestion de ces organisations ce qui contribuerait à venir à bout du problème de l'infrastructure. A cette fin, le Comité a conclu qu'une interaction accrue des fonctionnaires au Canada était souhaitable -peut-être au moyen d'associations nationales renforcées. Il existe de nombreux facteurs du manque de fonds dont on a déjà débattu plus haut.

COMPARAISON AVEC LES ETATS-UNIS ET L'EUROPE

Cette étude montre que les zones urbaines canadiennes affrontent des problèmes similaires à ceux qui ont été identifiés dans les études américaines. Le manque de revenus au niveau des gouvernements locaux est peut-être moindre qu'aux U.S.A., mais d'autre part la diminution de l'aide fédérale est plus grave. Les études, aussi bien aux Etats-Unis qu'au Canada, ont identifié les chaussées comme ayant le plus grand besoin d'attention. Il y a des ressemblances pour la plupart des autres formes de l'infrastructure. Les U.S.A. ont reconnu le problème plus tôt et essayent déjà de le résoudre. Le public américain est infiniment plus conscient du problème et on y a déjà voté ou on y élabore des lois pour augmenter les fonds des travaux d'infrastructure. Certaines des solutions réalisées aux U.S.A., comme les programmes de fonds du gouvernement fédéral pour aider les municipalités en difficulté, pourraient s'appliquer au Canada. Dans les deux pays, il est clair que les gouvernements locaux ont besoin de sources de revenu supplémentaires et d'assistance afin de venir à bout des arriérés de travaux et d'éviter une détérioration ultérieure de l'infrastructure.

Au printemps de 1984, l'Association américaine des Travaux Publics, la Ligue Nationale des Villes des U.S.A. et la Fédération des Municipalités Canadiennes ont patronné une série de séminaires sur l'infrastructure urbaine dans différentes villes européennes. Ils ont montré que les conditions de l'infrastructure urbaine actuelle en Europe sont relativement acceptables, sauf quelques exceptions. Ce sont les paiements des utilisateurs qui financent en grande partie les égoûts et le système hydraulique, ce qui s'est, jusqu'à récemment, avéré adéquat. Les gouvernements centraux s'engagent considérablement dans les travaux de l'infrastructure urbaine par l'entremise de subventions et de mesures pour partager les coûts avec les gouvernements locaux. Il en coûte de cet investissement plus grande de la part des gouvernements centraux une autonomie bien moindre des gouvernements locaux dans le domaine des priorités et des prises de décisions.

Récemment, les gouvernements centraux européens ont commencé à contrôler les tarifs des utilisateurs et à diminuer les subventions. Les fonds des gouvernements sont insuffisants et désormais on ajourne les travaux d'entretien et de remplacement. Un arriéré de travaux commence à s'accumuler dans les zones urbaines, mais ce n'est pas encore trop grave.

Pour tenter de réduire le fardeau du gouvernement, il existe une tendance vers la privatisation. En Angleterre, la construction de logements par le privé augmente énormément. On observe de semblables changements en France et en Allemagne. Certaines municipalités européennes emploient des méthodes de financement "innovatrices". L'une d'elles consiste à engager la municipalité dans des entreprises privées comme les banques et les mines. Les profits qui en découlent sont employés à compenser les déficits des charges gouvernementales. L'annexe contient des renseignements supplémentaires sur la situation en Europe. Aussi bien aux Etats-Unis qu'en Europe, on note des progrès dans la mise en place de standards de service. Le Canada devrait les rejoindre dans cet effort.

CONCLUSIONS ET RECOMMANDATIONS

En se basant sur des études précédentes, sur sa propre expérience, et sur les résultats de l'enquête exposée dans ce rapport, le Comité Technique sur l'Infrastructure Urbaine au Canada est abouti aux conclusions suivantes et fait les recommandations suivantes:

1. Une détérioration considérable a affecté les conditions de l'infrastructure urbaine au Canada. Il faudra prendre des mesures pour mettre fin à cette tendance.

2. Les couts pour ramener les formes les plus gravement détériorées de l'infrastructure (égoûts, eau, ponts et chaussées) à des niveaux acceptables sont élèves. Même s'ils sont étalés sur une période de redressement de 10 ans, ces coûts représenteront une augmentation des budgets de travaux publics actuels d'environ 25%.

3. Afin de résoudre le problème identifié du manque de revenus, il faudra trouver des sources de fonds supplémentaires chez les gouvernements locaux.

4. Réunir les fonds requis adéquats sera au-delà de la compétence de nombreux gouvernements locaux et les autres niveaux de gouvernement devront apporter une certaine aide.

5. Il faudrait former de meilleurs systèmes de renseignements, en particulier dans les plus petites municipalités, afin de permettre une meilleure gestion des systèmes d'infrastructure et une utilisation plus efficace des fonds disponibles.

   Le manque de renseignements a souvent été donné comme raison pour ne pas avoir rempli le questionnaire.

6. Il faudrait parvenir à un échange plus grand d'information entre les employés municipaux canadiens au moyen d'associations nationales renforcées et la publication de manuels sur la pratique de la gestion.

7. Pour atteindre un degré plus élevé de cohérence nationale aux niveaux des services de l'infrastructure, il fraudrait commencer le travail par la mise en place de standards de service. Ceci devrait se faire de concert avec les U.S.A. et les pays européens qui y travaillent actuellement. Il s'agit là d'un effort à long terme et la reconstruction de l'infrastructure ne devrait pas attendre son achèvement.

8. Il faudrait étudier des méthodes qui réduiraient le gaspillage et l'excès des coûts dûs aux délais et aux autres obstacles à la reconstruction et à l'entretien de l'infrastructure.

9. Sans compromettre l'apport de nouvelles installations nécessaires pour faire face à l'accroissement, il fraudrait mettre davantage l'accent sur l'entretien et la reconstruction au lieu de constructions nouvelles, spécialement dans les programmes fédéraux qui seraient élaborés dans l'avenir. Ceci devrait prolonger l'existence des installations actuelles.

10. Les Gouvernements locaux devraient ré-examiner leurs priorités de façon à mettre l'accent sur les services de base les plus essentiels au cours des périodes de grave restriction. Si ce n'est pas fait, la santé économique de nos zones urbaines peut être menacée, et par là même les autres services.

11. La FCM devrait fixer des politiques qui définiraient la base et les lignes directrices d'un redressement. La FCM orienterait son Comité Spécial sur l'infrastructure urbaine, par l'entremise de son Comité Technique, pour élaborer des politiques particulières.

12. Il faudrait établir des programmes pour commencer à réalizer ces politiques et la reconstruction des formes détériorées de l'infrastructure au cours des 10 prochaines années.

13. Il faudrait constituer une association intergouvernementale qui ferait aboutir les efforts conjugués et coopératifs des trois niveaux de gouvernements à la solution do problème de l'infrastructure. Il existe réellement une chance de reconstruire notre infrastructure urbaine, d'augmenter la compétitivité de nos zones urbaines, de renforcer le redressement économique du Canada, et, en même temps, d'employer un grand nombre de Canadiens dans ces travaux qui exigent une forte main d'oeuvre.

14. Il se peut que les priorités nationales doivent s'efforcer de connaître qui le Canada est en train de devenir une nation de plus plus urbainisée. C'est dans nos zones urbanisée qui la majorité des Canadiens vit et c'est là que se produisent nos plus grands problèmes.

15. Il faudrait éveiller davantage la conscience du public au problème de l'infrastructure afin d'obtenir son appui pour les mesures de redressement nécessaires grâce à une large propagation de ce rapport et des autres moyens disponibles à la FCM.

16. La FCM devrait demander à son Comité Spécial, par l'entremise de son Comité Technique, de procéder à la phase II de cette étude, de façon à cristalliser les politiques et à élaborer les programmes nécessaires à une action rectificative en coopération avec les autres niveaux de gouvernement, quand nécessaire.

17. L'évaluation des coûts de la phase II atteint $50,000. Il faudrait pourvoir les fonds necessaires à cet objectif.

II. INTRODUCTION

II.1 Importance of Infrastructure

Public works facilities, systems and functions such as sewer, water, street systems, bridges, parks, community centres and public theatres are collectively referred to as urban infrastructure. These facilities and systems play an important role in the functioning of urban areas, in fact, some forms of infrastructure as, for example, sewer and water systems, roads and bridges are essential to the very existence of cities. History has shown that without adequate sewer and water systems, sanitation and disease control are impossible in large cities. Pestilence and epidemics are a certain result when these sytems are inadequate.

In small urban concentrations, it is possible to live and work virtually in the same location. As urban areas increase in size, however, the need for adequate road systems increases. A point is reached where congestion can reach levels totally incapacitating a city under certain conditions. In larger cities the commonly perceived necessity of the work trip each morning and evening is just the tip of the iceberg. Road systems are also needed for delivery of goods, for shopping trips, for business trips, for recreation and for many other purposes related to travel. Road systems are also necessary for effective police and fire control and they are essential as corridors containing the necessary utilities, which not only include sewer and water systems, but gas, power communications and lighting.

Many of these systems are built to last. Sewer and water systems, as well as bridges can last over 100 years. There is a tendency, therefore, once they are in place, to take them for granted - to neglect their maintenance. Only when faced with the rebuilding in a very short time what was constructed in a century as is now occurring in some cities in North America does the importance of these basic essential infrastructure systems become apparent.

II.2 The Problem

Generally speaking the maintenace of urban facilities was kept up-to-date until the 1970's. The post-war rebuilding and the addition of new facilities as populations grew rapidly, plus generally adequate funding for maintenance and rebuilding resulted in an acceptable situation.

The higher inflation rates of the 1970's, however, resulted in rapidly growing costs and taxes. At the same time, society underwent a period wherein a growing array of new services designed to improve the quality of life were increasingly provided by government. This added to the tax burden. Ultimately, the combination of these effects resulted in growing public resistance to tax increases. Proposition 13 in California is a classic example of the results wherein funding for public works was severely reduced. At the same time interest rates soared as a result of the high inflation and a formerly reliable and consistent source of funding, local government borrowing, was also reduced while local governments waited for lower interest rates to return. Adding to the problem was a growing concern with the environment and with local area livability. Many needed repairs to streets have been delayed and in many cases completely prevented by concerns that such improvement would increase undersirable through traffic.

Large, old trees are causing increasing damage to sidewalks, streets and sewers but their removal or replacement is strenuously resisted. These and other similar impediments have made it more difficult to do necessary rebuilding and costs have risen as a result.

In the 1980's the serious recession which the western world has undergone has added to the problem. Even though inflation rates are now significantly down and borrowing is more reasonable and in fact facilities can be constructed at very favourable prices to the tax payer, there is extremely strong pressure on governments at all levels for restraint in spending. Thus, the problem continues and the backlog of necessary work grows.

II.3 Federal Government Involvement

The financial burden of maintaining and rebuilding the infrastructure in Canada has been generally that of the local governments. The federal government in Canada has been involved much less than has the U.S. federal government in this work. There is nothing in Canada that is equivalent to the massive Interstate Highway program which the federal government funded in the U.S. Much of the work was carried out in U.S. urban areas and took the pressure off the local governments. Central government participation is even greater in European cities.

Federal programs such as "Winter Works" in Canada have been geared towards reducing unemployment. This has been equated to the provision of new works, presumably because maintenance of existing infrastructure is an ongoing function and new jobs would not result from input into this field.

Today, input into this field of reconstruction can put laid off workers back to work and hopefully this reasoning will be abandoned. At any rate what federal input existed has now been virtually eliminated. There are few ongoing winter works programs now.

II.4 Economic Effects

Economic effects are three-fold. First, inadequate urban infrastructure can be directly related to the economic health of urban areas. Inadequate street and road facilities result in congestion. Congestion means wasted fuel, which today is very expensive. Congestion means more accidents which are a real and measurable drain on the economy. Congestion means increased travel time which is particularly detrimental to trucking and other forms of goods movement. There are also secondary effects like the increased cost of goods which the community requires. A larger portion of income must be expended (and in fact wasted) to make up for these deficiencies in infrastructure. The standard of living is therefore affected. Mobility is a highly valued aspect of the quality of life style. It permits variety of residence, variety of work and of recreation. Collectively, the above negative economic and social effects of inadequate infrastructure reduce our quality of life.

Another economic effect is that the competitive position of Canada's industry and commerce is reduced by inadequate infrastructure. Poor sewer and water systems, poor accessibility and congestion all make cities less competitive. As Canada begins to emerge from its recent recession it is becoming increasingly apparent that the future world is going to be a more competitive world. Industries must re-tool so that their plant is efficient and productive. Part of the plant they depend on is the urban infrastructure.

Finally, there is the matter of high unemployment currently prevailing in Canada. Works related to the maintenance, repair, rebuilding and necessary expansion of urban infrastructure such as sewer, water, street and bridge systems are highly labour intensive. There is a golden opportunity at this time to employ many people for this essential reconstruction of the infrastructure. At the same time advantage can be taken by local governments of the very attractive prices for contract work. The combination of the foregoing can contribute to the economic recovery of Canada by making Canada more competitive and reducing unemployment.

II.5 Public Awareness of the Problem

In the U.S.A., the public is very much aware of the problem. There has been considerable media coverage and a large number of studies have been carried out. Appendix A of this report contains a literature review.

Not only has the problem been identified in the U.S.A. but remedial measures are already underway. A bill has been approved by President Reagan providing for highway user charges, the proceeds of which will be earmarked for highway repair and replacement. A "Compromise Bill" (S1330) is being considered which would provide for block grants to states. There has also been debate on a $6 billion inland waterway authorization bill and an omnibus water resources bill (HR3678). Currently, a new bill is being drafted by the House Public Works Sub-Committee on Economic Development to aid infrastructure construction and rehabilitation. This bill is expected to provide loans and grants to communities unable to obtain conventional financing for public works. An inventory and condition assessment process is being developed to help set priorities. A number of federal and state infrastructure funding authorities are being proposed.

In the U.S.A. there is an acute awareness of the problem and its effect on the economy and the recovery from the recession. In Canada, there is considerably less awareness by the public in general. There has been some participation in the U.S. studies (the Chairman of this Canadian Technical Committee was a member of the APWA Task Force on Revenue Shortfall). There was also participation in the European seminar on infrastructure problems in the spring of 1984. In addition, the Canadian Construction Association has carried out some studies of infrastructure deficiencies in Canada (The Road Information Program - TRIP), but this has been restricted to rural facilities so far. Some provinces have "Needs" requirements for funding which are outlined in Appendix A. To date, however, there has not been a national study comparable to those in the U.S.A. The understanding of the Canadian problem is, therefore, lagging that in the U.S.A.

II.6 Federation of Canadian Municipalities' Task Force on Infrastructure

In 1983 the FCM recognized that an infrastructure problem existed in Canada. To deal with the matter it established a task force on Canadian Municipal Infrastructure chaired by Mayor M. Harcourt of Vancouver. The terms of reference of this task force and its objectives are:

1) To inventory the present condition of municipal infrastructure in Canada.

2) To establish trends in municipal spending on maintenace and replacement of municipal infrastructure over the past fifteen years.

3) To document trends in Federal and Provincial Government spending on capital programs to assist with the construction, maintenance and replacement of municipal infrastructure.

4) To report on methods of financing municipal infrastructure work throughout Canada.

5) To describe municipal infrastructure projects necessary tc bring municipal infrastructure to acceptable levels.

6) To make recommendations for halting the decline of municipal infrastructure and establishing adequate on-going municipal funding levels.

7) To recommend policies to all levels of government respecting future programs for the reconstruction and maintenance of municipal infrastructure.

In January of 1984 the Task Force established a Technical Committee composed of senior technical officials from all areas in Canada. The members of this committee are listed on the inside front cover of this report. The Chairman of the committee has participated in one of the U.S. studies and also in the European seminar. One member represents the Maritimes, two Quebec, two Ontario and one each from the Western Provinces. Three are from smaller municipalities.

A presurvey of mayors of Canadian municipalities was conducted. Its purpose was to determine whether mayors felt an infrastructure problem existed in their municipalities, and if so, whether they would participate in a study on infrastructre. The majority of respondents indicated that a problem did exist, that there were funding deficiencies and that they would participate in a study of the problem. The Technical Committee then reviewed existing information in Canada as well as information from other countries and decided that a national survey of municipal infrastructure was required to assist in defining the Canadian situation concisely. The terms of reference of this survey and study were to determine the physical status of Canada's urban infrastructure, funding adequacy, possible causes of inadequacies, and possible solutions to the problem.

The national survey was carried out between February 15 and April 1, 1984. The information obtained from the survey was analyzed and the results, together with those from the presurvey of mayors, are presented in this report.

II.7 Limitations of the Study

There are many forms of urban infrastructure. Previous studies have sub-divided these into two groups. The first - physical infrastructure - includes roads, bridges, water and sewer systems, communications, mass transportation, etc. The second group - social infrastructure - includes such functions as public health, education, fire safety, police protection, recreation, etc. The American studies have concentrated almost entirely on the physical infrastructure and particularly on sewer and water systems, roads and bridges. Although it is clearly recognized that social infrastructure is very important to the livability of urban areas, the basic physical infrastructure is essential to its very existence and priority seems to have been given to this aspect of infrastructure for this reason. Also, as is noted in all of the American studies above, the facilities suffering the greatest decline are roads, sewer systems and in general the physical infrastructure.

This Canadian study has included in its survey both forms of infrastructure in general terms. An insight into the relative condition of most forms of infrastructure (including physical and social forms) is provided. This Canadian study has also attempted to quantify information on the sewer, water, roads and bridge forms of infrastructure. For these types of infrastructure, costs to repair and replace to adequate levels are estimated and reported.

Some important forms of physical infrastructure are excluded from the study. For example, communication systems, transit systems, etc. These are beyond the scope of this work. There is a separate FCM task force on transit. A further limitation is that only urban infrastructure is considered herein. Rural facilities and those generally the responsibility of the provincial and federal governments are not included except where they are located in urban areas.

In view of the short time available to carry out the survey and study (January 1984 to May 1984) this first report is only a preliminary assessment of the problem. It attempts to establish the magnitude of the problem, identify the most critical areas of deterioration, identify the causes and set a foundation for future work. As such it is termed the Phase I study. Phase II, if approved by the FCM will crystallize FCM policies and begin the work of establishing programs to deal with the problems identified. It is hoped that further work can be done on other aspects of infrastructure which have been covered only in general terms in the Phase I work.

II.8 Objectives of this Study

As is noted above, this report covers only Phase I of the study. More work is required before definition of concrete action in terms of remedial programs is possible. This study, however:

1) provides a preliminary assessment of the status of Canadian urban infrastructure and funding availability.

2) sets the foundation for further action by the FCM which would include crystallization of policies and initiation of programs.

3) provides basic information with which the FCM can approach Provincial and Federal Governments for assistance where appropriate; recognizing that the basic responsibility is with local government.

4) provides bench mark information to municipal staffs on levels of services, priorities, and on information and management system requirements.

5) provides a vehicle through which public awareness of the problem can be increased and hopefully public support for remedial measures obtained.

III. INFORMATION FROM OTHER SOURCES

This chapter contains a summary of information derived from sources other than the 1984 national survey. It does not reflect survey results which are described in following chapters.

III.1. Situation in Canada

During the past two decades interest in maintaining the natural environment has emerged in society. Public consciousness has become increasingly aware of the problems of natural resource depletion and pollution of the environment.

Recently, another heritage seems to have been discovered which has long been taken for granted - the inheritance of public works facilities. Much of this infrastructure, installed during the past century, provides an essential foundation for the economic and social activities occurring in urban centres. Because this infrastructure is often hidden from view (buried underground), it is largely ignored by the public. It is not until failure occurs and these services are no longer provided that the importance of proper care and maintenance of public infrastructure is realized. Symptoms of decay and inadequacy such as a worn out, 100 year old water supply system in Yarmouth, N.S., or major rehabilitation needs for Toronto's elevated Gardiner Expressway are not identified as examples of a deteriorating infrastructure but rather as separate, unrelated incidents. Public pronouncements of increased spending on public works typically cite job creation as their rationale rather than the problems of infrastructure decay.

There has been no comprehensive analysis of the present condition of the infrastructure in Canada at the national level. However, the problems of declining budgets, tight money markets and restraints on government spending are significant. Whether or not this has led to deferred maintenance and a deterioration of infrastructure condition cannot be stated categorically. However, because this report was initiated by the mayors, public works commissioners and chief engineers of major Canadian municipalities, it shows that there is indeed concern in Canada about the current condition of municipal infrastructure.

The following sections provide information on the Canadian situation. Further details are contained in Appendix A.

III.1.1. Water Supply and Distribution

In 1981 there were 1755 Canadian communities with water treatment plants serving a population of 17,244,598 or about 82% of the surveyed population. There were 2474 communities with water distribution systems serving 20,275,786 or about 97% of the surveyed population. It is unknown what the total length of water distribution main is, however, work done for Ontario suggests an

average density of 200 persons per km of watermain. If this density can be applied nationally, it indicates approximately 100,000 km of watermain in Canada.

The condition of Canadian water systems is not well known. The major cities in the central and eastern regions probably have watermains in their systems in excess of 100 years old, however, considering the post-war construction boom, an average age of about 40 years is likely for these regions. In the west, average ages are probably less.

A study carried out for the Ontario Ministry of the Environment suggested that rehabilitation costs of approximately $25 per capita per year would be needed to maintain water systems at an acceptable level. Using an estimated population of 20,000,000, $500 million per year is required to rehabilitate water distribution systems. It is estimated that municipalities are currently spending only from $6 to $9 per capita on maintenance. This implies a revenue shortfall of up to $350 million per year.

III.1.2 Sewage and Wastewater Treatment

Of 3212 Canadian communities surveyed in 1981, 2102 communities were served by sewer systems representing a population of 17,872,705. This represented 85% of the surveyed population. Of these only 65% are on a system that discharges to some form of sewage treatment plant.

As with the water supply systems, the condition of sewer systems in general is not known. The situation is more complicated than for the water system because of the presence of combined storm and sanitary sewers. The majority of the population is served by relatively new separate sanitary sewer systems. However, the larger older systems are generally combined. In Toronto, wherever combined sewers are too small, it is common practice to build parallel storm sewers.

The national survey of sewer and water systems estimates that infiltration and inflow accounts for about 9% of total flows in sanitary sewers. This does not indicate an alarming state of neglect nationally, but all extraneous inflow is costly to transport and treat and should be minimized. The Ontario survey estimates that sewers in the province average 30 years of age and should achieve a minimum life of 100 years. A program of repairs and renovation at a cost of about $15 per capita per year is required to maintain the system. This is approximately three times the current spending levels.

III.1.3 Roads and Streets

Pavement management systems have been initiated in a number of Canadian municipalities. In some provinces standardized approaches to inventorying pavement condition and rationally assessing needs are a precondition to receiving provincial funding. However, such studies are often confidential due to their use in allocation of funds at the provincial level. In Ontario, the provincial budget for municipal roads has declined in real terms since the mid-seventies. This may be due in part to increased amounts of preventative maintenance resulting in less reconstruction. Or it may be due to a decrease in new road construction. However, it may also be a result of an increase in deferred road maintenance due to budgetary constraints.

The Road Information Program of Canada (a committee of the Canadian Construction Association) estimates that in Manitoba some 600 miles of provincial trunk highways need repair annually at an annual cost of $100 million dollars over the next five years. A City of Edmonton road needs study showed that over $1 billion should be spent over the next ten years. Of this amount at least one-half was for reconstruction and repair of existing roads and bridges while the rest was for new construction.

III.1.4 Summary of the Canadian Situation

Lack of data makes it difficult to develop generalizations regarding the condition of municipal public works facilities and infrastructure. It is feared that the few locations which do commission studies and have implemented maintenance management systems are representative of only the relatively well-maintained cities. Those areas where very little data are kept may indeed represent a mounting backlog of needs.

The isolated Canadian studies show that while all cities may not exhibit similar degrees of need in the same areas, almost all municipalities have some infrastructure needs which they are unable to satisfy. It is anticipated that the primary problems facing Canadian municipalities are ongoing budget constraints and cutbacks. Fiscal restraint is tending to make many traditional maintenance procedures obsolete.

III.2 Situation in the United States

Some of the most significant studies in the U.S.A. have been:

"America in Ruins" by Choate and Walter in cooperation with the Council of State Planning Agencies - this 1981 report identifies the growing problem in the U.S.A. It notes that one of five bridges in the country is in poor shape. It points out that funding for capital investment purposes for

public works in general has declined by 21% in the period 1965 - 1977. In the same period, per person expenditure on this type of infrastructure in real dollars has dropped by 29%. Expenditure on roads and streets has dropped by 50%.

"Revenue Shortfall" by the American Public Works Association - this 1981 report, reflecting a survey of urban areas, notes that funding has dropped in the 1970's by 18% in the U.S. and up to 31% in Canada. The report identifies causes of deterioration and declining funding and makes recommendations for corrective actions.

"Capital Budgetting and Infrastructure in American Cities" by the National League of Cities - this 1983 report based on a survey of 1400 American cities outlines the deterioration of various forms of physical infrastructure in the U.S.A. As with "America in Ruins" it identifies streets and sidewalks as being the facilities in worst condition (70% of cities concerned), followed by sewer systems. The report identifies the need to place priority on works which protect public health and safety. A close third is the necessity to enhance economic development. The report identifies the need in assistance from senior governments but at the same time "strongly supports the view that any national effort in this area should rely primarily on local planning and local priorities, within broad national purposes". The report identifies a clear connection between adequate infrastructure and the economic health of cities.

"Rebuilding America's Vital Public Facilities" by the Labour Management Group coordinated by Professor Dunlop, Harvard University - this 1983 report brings together an impressive group of labour management leaders in the U.S.A. to deal with the infrastructure problem. As with other American studies the report concentrates on highway, bridge, sewer and water systems noting that other essential forms of infrastructure, as important as they are, are beyond the scope of the study. A key statement in the report is "the belief is soundly conceived and widely held that public physical facilities are essential to the functioning of the nation's economy". This report quantifies the needs and identifies a total annual need in 1981 dollars of $38 billion. It notes that about $28 billion is being spent and that there is a shortfall of $9 - 11 billion per year. Again, highways and bridges are identified as the most pressing need.

"23 State Studies" commissioned by the Joint Economic Committee of Congress - among these is "The Washington State Infrastructure Study" - 1983. Again, roads are identified as the most pressing problem followed by various forms of other infrastructure. Another is "California's Infrastructure" - 1984. This report notes that: "years of deferred maintenance and inadequate repair are catching up with us". The report

identifies the lack of reliable information and management systems, it makes a case against the growing tendency to finance everything through user charges and it makes a number of recommendations to deal with the problem including the formation of a State Funding Authority. The study of the 23 participating states shows that there is an overall $443 billion shortfall in funding over the next 16 years. These costs include State systems as well as urban systems.

The major findings of these U.S. surveys show that there is indeed a general deterioration of the municipal infrastructure and a backlog of needed repairs. However, although the initial gross estimates of needed expenditures to upgrade municipal infrastructure were very high, more detailed surveys have shown that significant progress could be achieved on priority items with only a moderate increase in expenditures.

Revenue shortfall is usually placed high on the list of problems leading to infrastructure deterioration. The solution therefore appears to be to increase revenues and expenditures and also to improve maintenance and repair technology. In the U.S. it is clear that investment in public works, measured in constant dollars, has been decreasing. In both absolute and relative terms, national investment in public works has been falling.

Within the municipalities surveyed by APWA, it was found that public works budgets were declining as a proportion of total budgets. Total budgets for municipalities measured in constant dollars also declined over the same period. Increases in municipal expenditures over the last decade have been greater than increases in revenues.

Taken together, the evidence of declining total budgets and the declining portion allotted to public works shows that public works facilities are losing the competition for scarce revenues in today's entrenched municipal economies in the U.S.

III.3 Situation in Europe and Britain

Europe and Britain have, in general, much older cities than North America and the problems of infrastructure decay are familiar to them. However, facilities such as water supply and sewage systems are actually not much older there than in North America. Europeans have also realized, during the last decade that they have been taking their physical infrastructure for granted. This is no longer the case due, in part, to a number of well-publicized sewer collapses in Britain and Europe.

In England, in 1977, the National Water Council published a report entitled Sewer and Water Mains, A National Assessment. For a serviced population of 55,625,000 (94% of the total population) there was a total length of 234,000 km of combined and sanitary sewers giving a use density of 241 persons/km of length. For water systems, the served population is 55,616,000 over a total length of 317,800 km of water main for an average use density of 175 persons/km.

In North America, system condition is often measured in terms of how much infiltration, inflow or leakage is occurring. In Britain, there is a greater emphasis on structural condition indicators such as the number of breaks per year and the analysis of visual surveys. Thus, system condition is related to structural deficiencies to a greater extent than in North America. The British experience is about 25 watermain breaks/year/100 km, which is similar to reported figures in North America. In Denmark and England, analysts have found it worthwhile to do visual inspections of sewer pipes using closed circuit T.V. and to use statistical sampling techniques to arrive at estimates of structural conditions for whole watershed areas. The National Water Council in Britain has published a Manual of Sewer Condition Classification which classifies defects in both structural and service conditions. This detailed standardized approach makes the assessment of conditions of large areas possible by statistical sampling techniques.

In the spring of 1984 the American Public Works Association, the U.S. National League of Cities and the Federation of Canadian Municipalities sponsored a series of seminars on urban infrastructure in various European cities. These have shown that existing European urban infrastructure is in relatively acceptable condition with some exceptions. Sewer and waterworks are financed largely from user charges which until recently have been adequate. Central governments are very significantly involved in urban infrastructure works through grants and cost sharing arrangements with local governments.

Recently, European central governments have begun to control user rates and restrict grants. Local government funding is inadequate and maintenance and replacement works are now being deferred. A backlog of work is starting to build up in urban areas but this is not serious yet.

In an effort to reduce the burden on government, there is a trend towards privatization. In England private housing is increasing dramatically. Similar changes are occuring in France and Germany. Some European municipalities use "innovative" financing methods. One of these is municipal involvement in private enterprises such as banks and mines. Profits from these are used to offset deficits in government functions. Appendix B contains further information on the European situation.

III.4 Summary

The review of information from sources other than the 1984 national survey shows that there has been no comprehensive analysis of the present condition of the infrastructure in Canada at the national level. However, localized Canadian studies show that while all cities may not exhibit similar degrees of need in the same areas, almost all municipalities have some infrastructure needs which they are unable to satisfy. In addition, the problems which contribute to infrastructure decline (declining budgets, tight money markets and restraints on government spending) are significant. Whether or not this has led to deferred maintenance and a deterioration of infrastructure condition cannot be stated categorically on the basis of this review.

In the U.S., there have been national surveys on infrastructure condition and revenue shortfalls. The major findings of these U.S. surveys show that there is indeed a general deterioration of the municipal infrastrucutre and a backlog of needed repairs. Revenue shortfall is usually placed high on the list of problems leading to infrastructure deterioraton. Within the municipalities surveyed, it was found that public works budgets were declining as a proportion of total budgets which are decreasing in constant dollars.

In Europe, the condition of existing facilities seems to be better than in Canada, and officials report less backlog of work. Except for one in England, there were no comprehensive national studies of infrastructure.

The Canadian situation is felt to be similar to that in the U.S.; the infrastructure systems are suffering from revenue shortfalls and, are thus deteriorating. Basic physical infrastructure systems such as roads are in the poorest condition in both countries. In Europe, the infrastructure systems are of such an age that they have already been through a cycle of revenue shortfalls and resultant deterioration and thus are in better condition than the Canadian infrastructure. As financial and technical solutions develop further in other countries, Canada will be wise to be fully informed of their successes and failures and benefit from their experience. As a first step, there is a need for a national survey of Canada's infrastructure.

IV. MAYORS' PRESURVEY RESULTS

IV.1. Survey

A preliminary survey questionnaire was sent to Mayors of FCM member municipalities in December of 1983 to obtain a profile on the perceptions held in their municipalities of the scope and nature of infrastructure problems. A copy of the survey form is enclosed in Appendix C (pages C.1 to C.4).

The specific purposes of this survey were:

i) to advise Mayors and Councils of actions by the FCM to address the problem of the disrepair of the urban infrastructure. FCM actions were a formal recognition of the problem and the creation of the Infrastructure Task Force.

ii) to determine whether there was a need for a national survey and study on the status of infrastructure systems, appropriate standards of maintenance and policies on economic strategies.

iii) to determine whether specific municipalities would be able and willing to contribute information on the state of their infrastructure and funding availability.

iv) to establish a contact person in the Municipality's organization who might coordinate the Municipality's input.

v) to seek the perception of Mayors on infrastructure problems, specifically:

   a) funding adequacy;
   b) deterioration of services; and
   c) economic strategies for dealing with infrastructure problems.

There were responses from 47 of the 245 FCM members surveyed: a 19% response rate. One non-member also completed the return.

Of those mayors responding, there was a great deal of enthusiasm to proposed FCM involvement in this area. Only two of the returns declined to participate in a further in-depth study of municipal infrastructure. This was owing to a lack of readily available information in the municipality.

IV.2. Results

Few municipalities feel their infrastructure maintenance is fully funded (Figure 1). Only 6 out of 45 respondents said there was full funding. Many municipalities, especially in the middle-size range, allocate considerable funding to infrastructure maintenance but most municipalities of all sizes consider that funding is not sufficient to meet the needs.

Concerning the potential of the various economic strategies in dealing with infrastructure problems, the results are not as clear cut (Figure 2). Many of the respondents chose a combination of the options and made comments that one option was suitable to a particular set of problems while another option would be used to advantage under other circumstances. There were a number of comments that debt financing was politically undesirable giving rise to the need for an emphasis on pay-as-you-go and user fees according to the circumstances. Debt financing appears to be favoured in major capital works projects. Pay-as-you-go and user fee arrangements are used to fund operating/maintenance costs and minor capital works. A consistent response in the "other" category points to the need for grant assistance from other orders of government to take up the funding shortfall.

The respondents chose a variety of services in their municipality which they perceived to be deteriorating (Figure 3). The most frequent problem area in municipalities of all sizes appears to be the road pavement, bridges and sidewalks categories. The deterioration of water and sewer systems was chosen by municipalities of all sizes in about half of the cases. In about 25% of the returns, deterioration in all three areas was perceived to be a problem. Lighting was perceived as a problem in some of the middle-sized municipalities. Flood protection was seen to be a problem in some municipalities and public transportation was perceived to be deteriorating in the smaller municipalities.

The regional breakdowns do not reflect dramatic differences in attitudes to the status and funding of municipal infrastructure. There does seem to be more concern with underfunding in municipalities in the eastern half of the country - a situation that could be attributed to the age of the infrastructure in those areas that have had longer-established urban populations.

A more complex approach to infrastructure funding arrangements is evidenced in larger municipalities in all regions of Canada. In these areas, combined strategies are offered to suit the nature and extent of the problems. Again, the emphasis on pay-as-you-go and user fees is reflected across the country.

Figure 1. Canadian Mayors' Perception on whether Funding for the Maintenance of the Infrastructure is Being Achieved

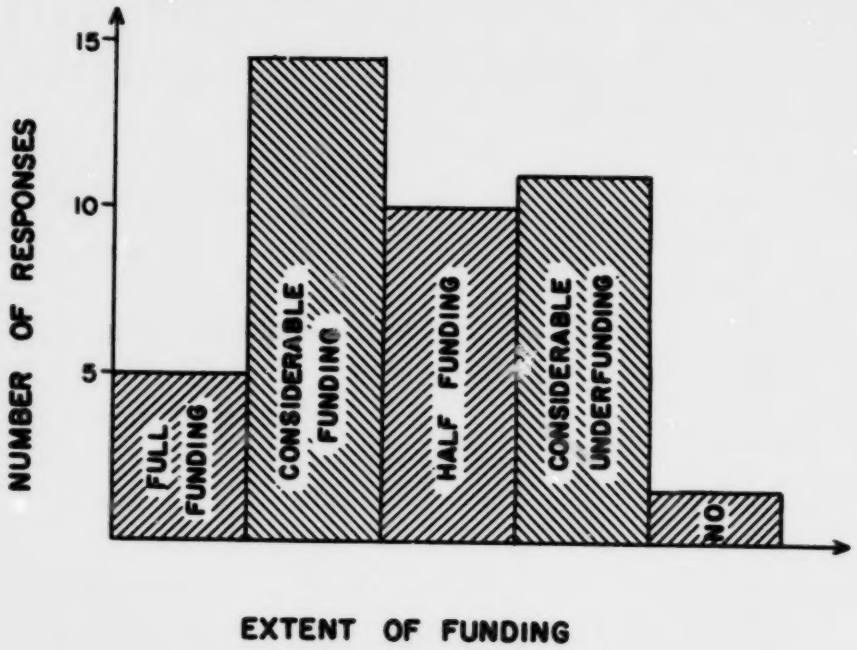


Figure 2. Canadian Mayors' Perception on the Best Economic Strategy for Dealing with Infrastructure Problems

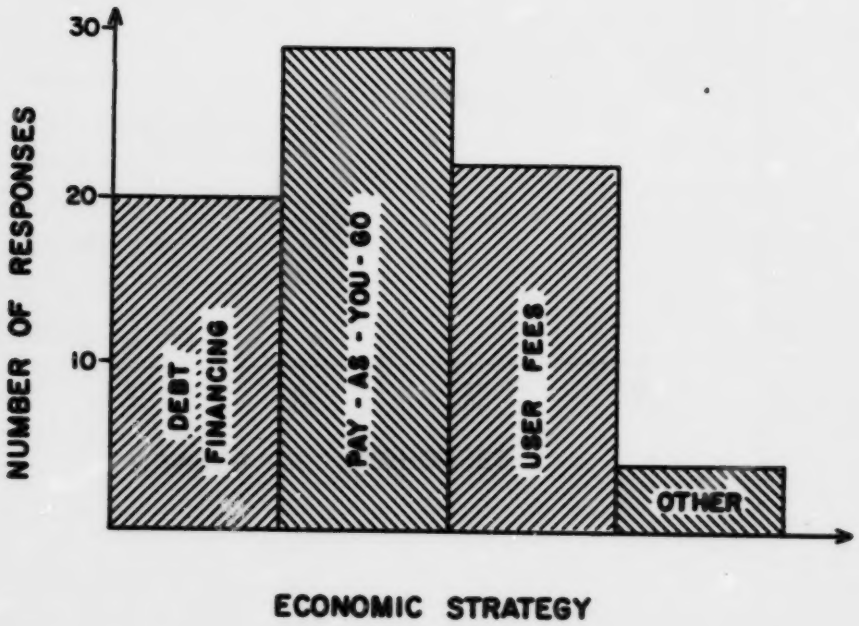
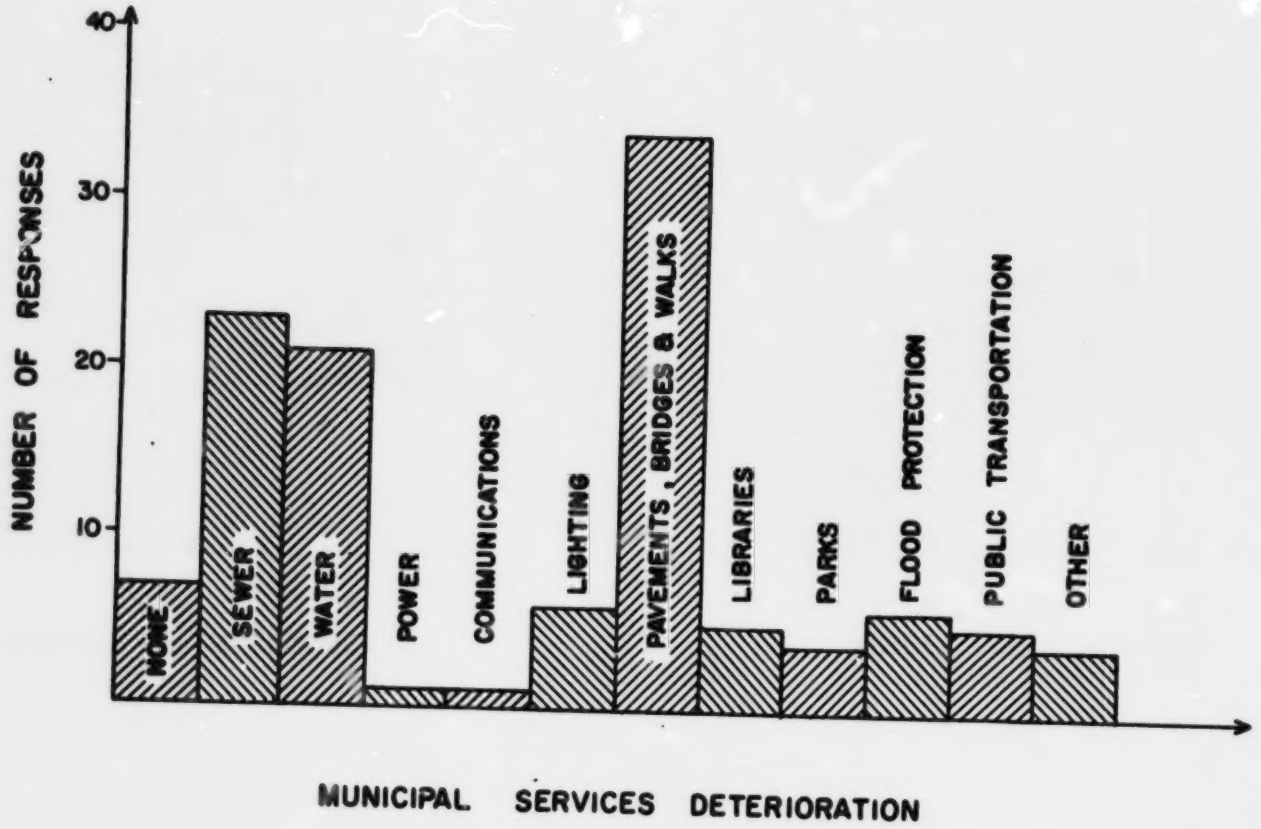


Figure 3. Canadian Mayors' Opinions on the Deterioration of Municipal Facilities



The concern for the deterioration of road pavements, bridges and sidewalks is fairly evenly distributed, geographically. There is a concentration of concern in Central Canada with water and sewer deterioration.

IV.3 Survey Comments

In reviewing the comments made on the questionnaire it became clear that there were, on the initial survey, very differing levels of technical expertise being applied. Some respondents made very technical comments on the impact of the different funding options, while others made comments on the limitations that they faced in providing technical information. However, most felt strongly about the need for research and most desired a renewal of financial assistance and cooperation from the other orders of government to help meet their communities' needs.

To summarize, Mayors agree the maintenance of infrastructure facilities is under funded. As a result, the infrastructure is deteriorating, particularly the road pavements, bridges, sidewalks, sewer and water systems. Economic strategies vary depending on the specific infrastructure system but there was a general desire to seek Federal and Provincial funding assistance. There was strong support for a National survey of infrastructure.

V. MUNICIPAL INFRASTRUCTURE SURVEY RESULTS

V.1. Purpose

The overwhelming response from the Mayors' Presurvey was that there was a need for a national survey and study on the status of infrastructure systems, appropriate standards of maintenance and policies on economic strategies. On the bais of this response and the review of information from other sources, the technical committee decided to conduct a national survey.

The purposes for this survey were:

i) to establish the status of the infrastructure systems in general for all forms of infrastructure as well as specific systems (i.e. sewers, waterworks, roads and bridges);

ii) to determine funding trends and deficiencies, if any;

iii) to determine costs to correct; and.

iv) to outline potential solutions.

V.2 Preparation and Distribution of Questionnaire

The questionnaire (included in Appendix C from page C.5 to C.22) was based on suggestions made by members of the Technical Committee and some previously prepared questionnaires for other surveys (Pre-survey of Mayors, TRIP/Canada). A draft was circulated to all Committee members and revisions were made.

The questionnaire (page C.8 and C.9 of Appendix C) contains general questions on current (1983) and past (1976 and 1968) populations, budgets and liability claims, and seeks opinions on infrastructure conditions and impediments to improvement. Infrastructure here includes a wide scope (ie. public buildings, parks, libraries, etc. in addition to the public works facilities). The bulk of the questionnaire (pages C.10-C.22 in Appendix C) seeks current (1983) and past (1976 and 1968) detailed information on the following public work facilities:

- Separate and Combined Sewer Systems
- Sanitary Treatment Facilities
- Water Distribution Systems
- Water Supply, Treatment and Storage Facilities
- Roads
- Bridges

The questionnaire was mailed on February 15 to all (235) FCM member communities and a few other municipalities and provincial authorities. It was hoped that most communities would be able to complete the general questions (C.8 and C.9 of the questionnaire shown in Appendix C). It was realized that relatively few communities would be in the position to complete the entire questionnaire in the short time period available, particularly with respect to historical information. An intensive telephone campaign was mounted by committee members to encourage a greater response. In addition, two follow-up letters were sent out (pages C.23-C.25 of Appendix C).

Eighty responses were received in the period March 15 to May 1. A summary of survey respondents is contained in Appendix D. There was insufficient time during Phase I to analyze and present all of the data contained in the completed questionnaires. There were also relatively few complete responses, making the presentation of some of the data questionable.

In many cases, "averaged" results are reported. Two different averages are used as appropriate:

(a) NUMBER OF RESPONSES AVERAGE: Average amongst municipalities regardless of size.

$$\text{AVERAGE} = \frac{\text{Total of the "scores" of each municipality}}{\text{Total Number of Municipalities}}$$

(b) POPULATION-WEIGHTED AVERAGE: average computed by weighting the "score" of each municipality by its population.

$$\text{AVERAGE} = \frac{\text{Total of (score of municipality)(pop.of municipality)}}{\text{Total Population of all Municipalities}}$$

V.3 Survey Results

The survey results are presented under eight subheadings:

3.1 Summary of Survey Respondents

3.2 Summary of Physical Conditions of Infrastructure - Current and Trends

3.3 Summary of Funding - Current and Trends

3.4 Summary of Costs and Impediments to Improvement (Infrastructure Needs)

3.5 Summary of Data on Roads, Water Distribution and Sewage Collection

3.6 Comparisons of Canadian Survey Results with the U.S. Experience.

3.7 National Projections from Survey Results

3.8 Summary of Survey Conclusions.

V. 3.1 Summary of Survey Respondents

Table 1 presents a summary of the survey response, of the survey sample (the FCM members), and of all Canadian municipalities with a population greater than 10,000. The information is presented in three categories of population size and by three regions (Figures 4.1 to 4.4). The following comments can be made:

- 80 responses were received by May 1 from a sample of 235 and a national total of 2192 communities (over 1000 population).

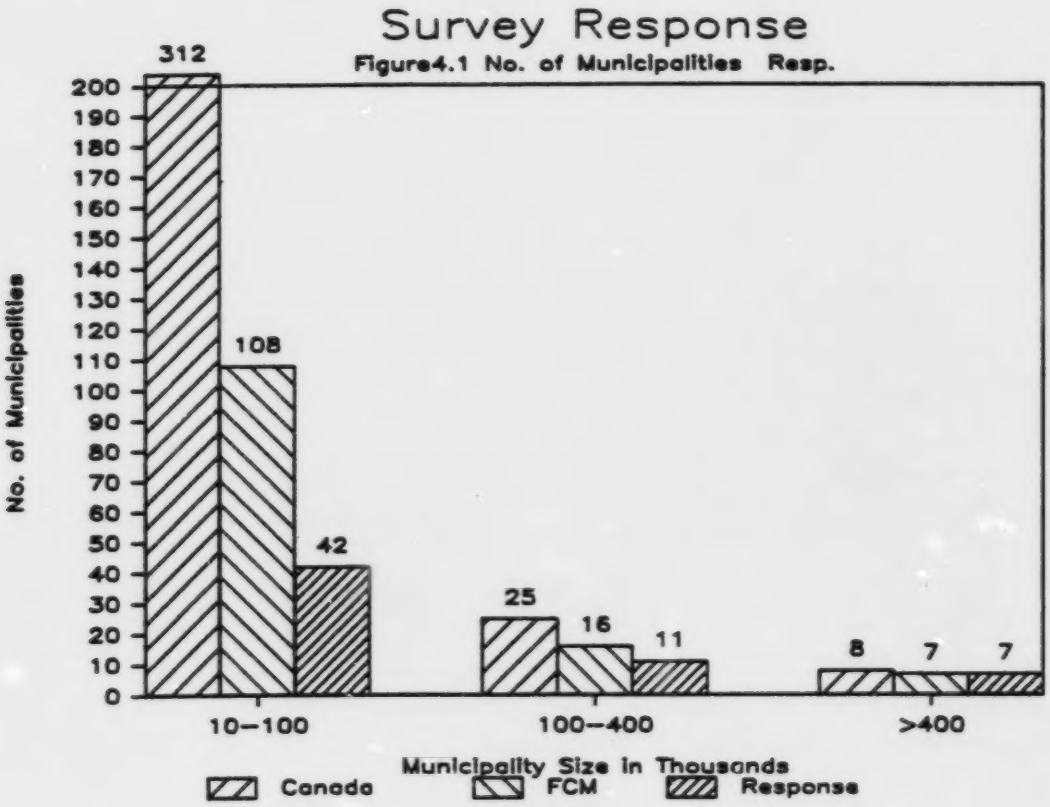
- 17 of these were received from municipalities with populations less than 10,000. These municipalities were deemed rural in nature with significantly different problems than the more urban type of municipality. These 17 communities represent a response of less than 10% of the FCM sample of communities with 1,000 to 10,000 population and less than 1% sample of the over 2,000 communities in Canada in the population range of 1,000-10,000. For these reasons the Technical Committee decided not to include them in the data presentation in this report. However, part of the data of these smaller communities are presented in a separate report.

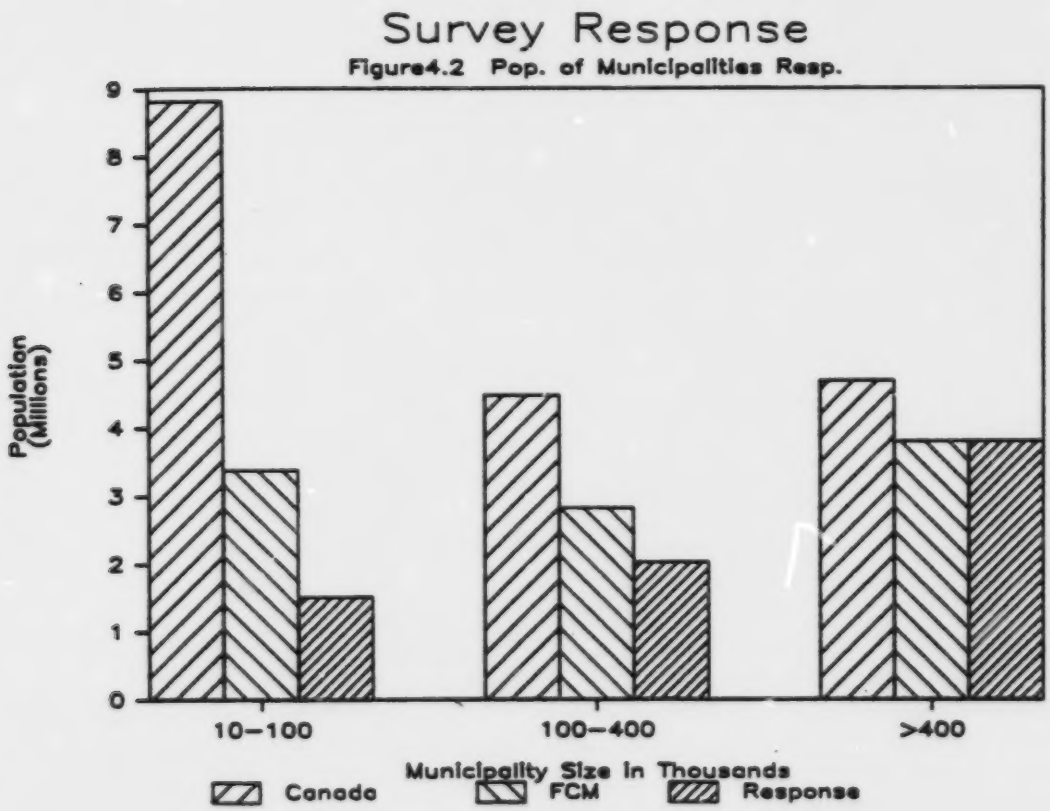
SUMMARY OF SURVEY RESPONSE
Table 1

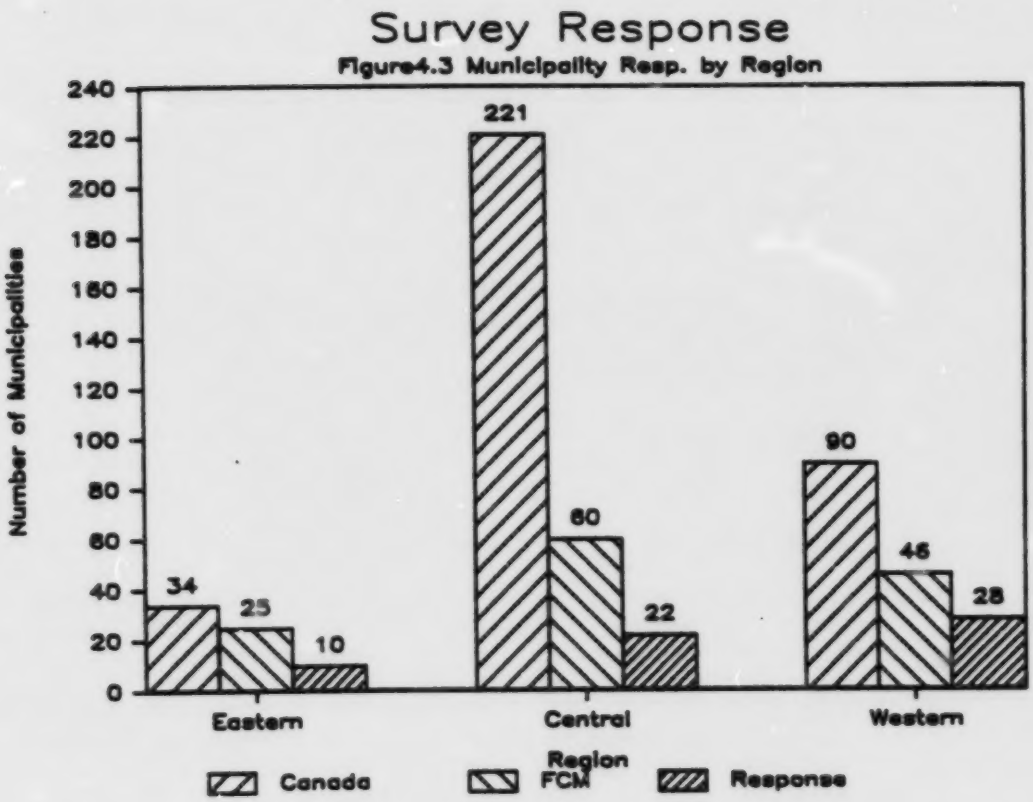
Population Group	Response* Number	Response* Population	FCM Members Number	FCM Members Population	Canada Number	Canada Population
(thousands)						
10–100	42	1,521,074	108	3,394,207	312	8,825,785
100–400	11	2,030,761	16	2,830,064	25	4,484,143
>400	7	3,810,528	7	3,810,525	8	4,707,565
Eastern	10	424,256	25	819,597	34	946,834
Central	22	3,607,732	60	5,342,093	221	12,091,777
Western	28	3,330,375	46	3,768,415	90	4,978,880
Total	60	7,362,363	131	9,930,105	345	18,017,491

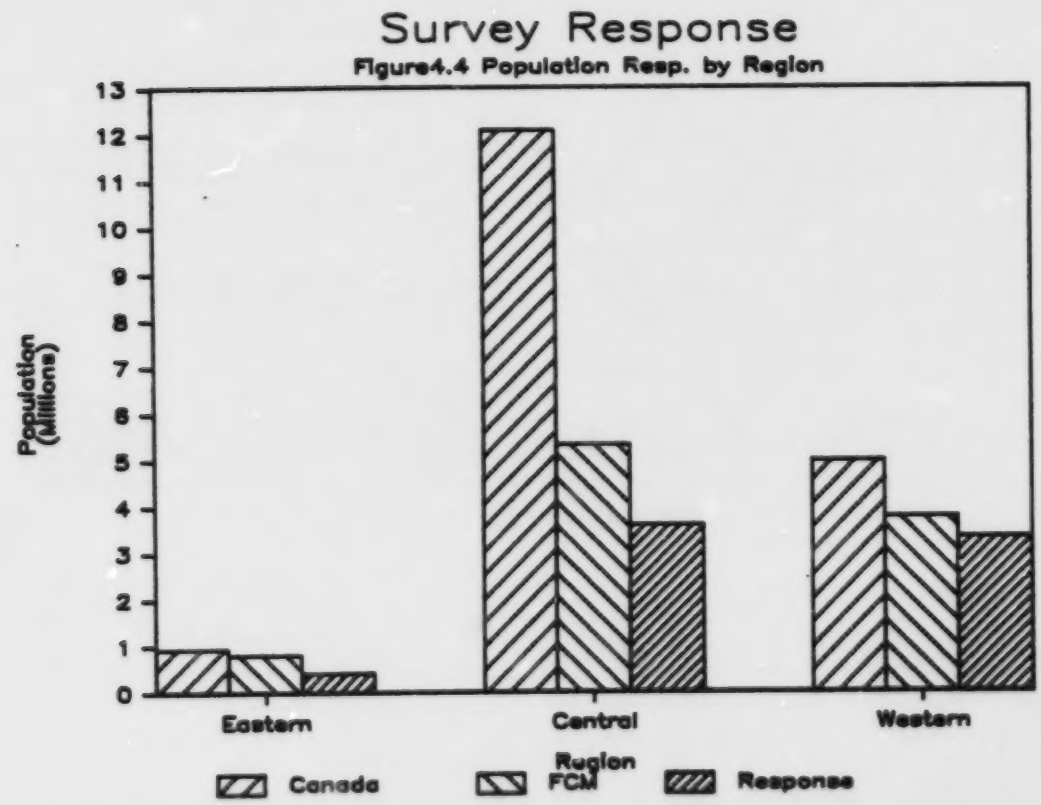
*Responses were also received from 3 Regional Municipalities with a combined population of 928,524 not included in the above total.

Eastern: Nfld., N.B., N.S. and P.E.I.
Central: Quebec and Ontario
Western: B.C., Alta., Sask. Man., Yukon and N.W.T.


Survey Response
Figure4.1 No. of Municipalities Resp.
No. of Municipalities
312
108
42
25
16
11
8
7
7
10–100
100–400
>400
Municipality Size in Thousands
Canada
FCM
Response


Survey Response
Figure4.2 Pop. of Municipalities Resp.
Population (Millions)
10–100
100–400
>400
Municipality Size in Thousands
Canada
FCM
Response


Survey Response
Figure4.3 Municipality Resp. by Region
Number of Municipalities
240
220
200
180
160
140
120
100
80
60
40
20
0
34
25
10
221
60
22
90
46
28
Eastern
Central
Western
Region
Canada
FCM
Response


Survey Response
Figure4.4 Population Resp. by Region
Population (Millions)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Eastern
Central
Western
Region
Canada
FCM
Response

- three responses were received from Regional Municipalities containing several urban municipalities, not all of which responded individually. The difference in population between the three metropolitan/regional municipalities and those that responded individually was 923,524 and is not included in the survey.

- the 60 responses used in the data analysis represent 17.4% of the total number of Canadian communities over 10,000 population but include 41% of the population in centres over 10,000 population.

- seven of the eight Canadian cities with populations over 400,000 are included in the response. (One additional was received since May 1 but was too late to be included).

- about half (18) of the cities over 100,000 (33) have responded.

- the sample for this survey (mostly FCM members), represents 50% of the nation's population in centres over 1,000 people, but represents dominantly the larger communities. For municipalities with populations between 10,000 and 100,000 the sample represented 38% of the population. However, 85% of the nation's population in cities over 100,000 population were included in the sample. For these reasons, national projections of specific results are limited to those urban centres with populations in excess of 100,000 people. To apply these projections to municipalities less than 100,000 population would not be sufficiently reliable.

- the Central region of Canada is not as well represented by the survey as the Eastern and Western Regions. This is again partly due to the limitation of the survey sample to FCM members. It appears that the FCM is not as well represented in Ontario and Quebec as in the other provinces.

V. 3.2 Summary of Physical Conditions of Infrastructure - Current and Trends

Table 2.1 (number of responses) and Table 2.2 (population-weighted responses) provide the results of the survey questions on age of various facilities, the present condition of infrastructure (Figs. 5.1 and 5.2), budget priorities for capital infrastructure (Fig. 6) and change in condition of infrastructure over the last 15 years (Fig. 7)

SUMMARY OF CONDITION OF INFRASTRUCTURE

Table 2.1 Percent of Municipalities Responding — 63 Municipalities

FACILITY	Age		Present Condition							Priority for Expenditure				Change in Condition			
	Resp.	Avg Age	Resp.	good	ok	some rep.	much rep.	no good	n/a	Resp.	1st	2nd	3rd	Resp.	Better	Same	Worse
Water Treat.	37	21	39	32%	17%	7%	8%	2%	21	32	24%	8%	19%	39	41%	13%	8%
Water Dist.	48	20	51	28%	25%	23%	7%	2%	9	39	17%	27%	17%	49	56%	14%	8%
Sewage Coll.	52	27	55	22%	20%	42%	8%	0%	5	42	14%	32%	21%	52	43%	29%	11%
Sewage Treat.	33	11	34	27%	12%	10%	3%	5%	26	25	22%	6%	11%	32	35%	10%	6%
Storm Sewer	49	21	55	19%	27%	32%	12%	3%	4	45	21%	22%	29%	55	41%	41%	5%
Roads	48	19	57	7%	18%	45%	23%	2%	3	45	41%	17%	13%	56	35%	19%	35%
Sidewalks	46	18	54	10%	27%	38%	15%	0%	6	41	13%	21%	32%	52	35%	25%	22%
Bridges	40	22	49	12%	20%	45%	5%	0%	11	33	8%	14%	30%	48	27%	35%	14%
Traf.Control	41	9	46	37%	27%	10%	3%	0%	14	31	13%	13%	24%	45	44%	24%	3%
Transit	15	6	19	15%	11%	3%	2%	0%	42	11	2%	8%	8%	19	22%	5%	3%
Solid Waste	31	11	36	28%	20%	8%	2%	2%	24	26	13%	17%	11%	36	27%	24%	6%
Pub. Bldgs.	43	19	49	25%	31%	20%	5%	2%	10	34	8%	17%	29%	48	37%	33%	6%
Park/Rec.	42	14	49	28%	25%	25%	2%	2%	11	36	11%	21%	25%	47	51%	21%	3%
Cultural	22	17	27	18%	18%	2%	3%	3%	34	16	2%	8%	16%	27	25%	11%	6%
Soc. Services	27	12	34	28%	25%	2%	0%	2%	26	21	0%	6%	27%	31	30%	17%	2%
Others	1	30	1	0%	0%	2%	0%	0%	59	1	0%	2%	0%	1	2%	0%	0%

NOTE: On the following graphs the Facility Names have the following abbreviations:

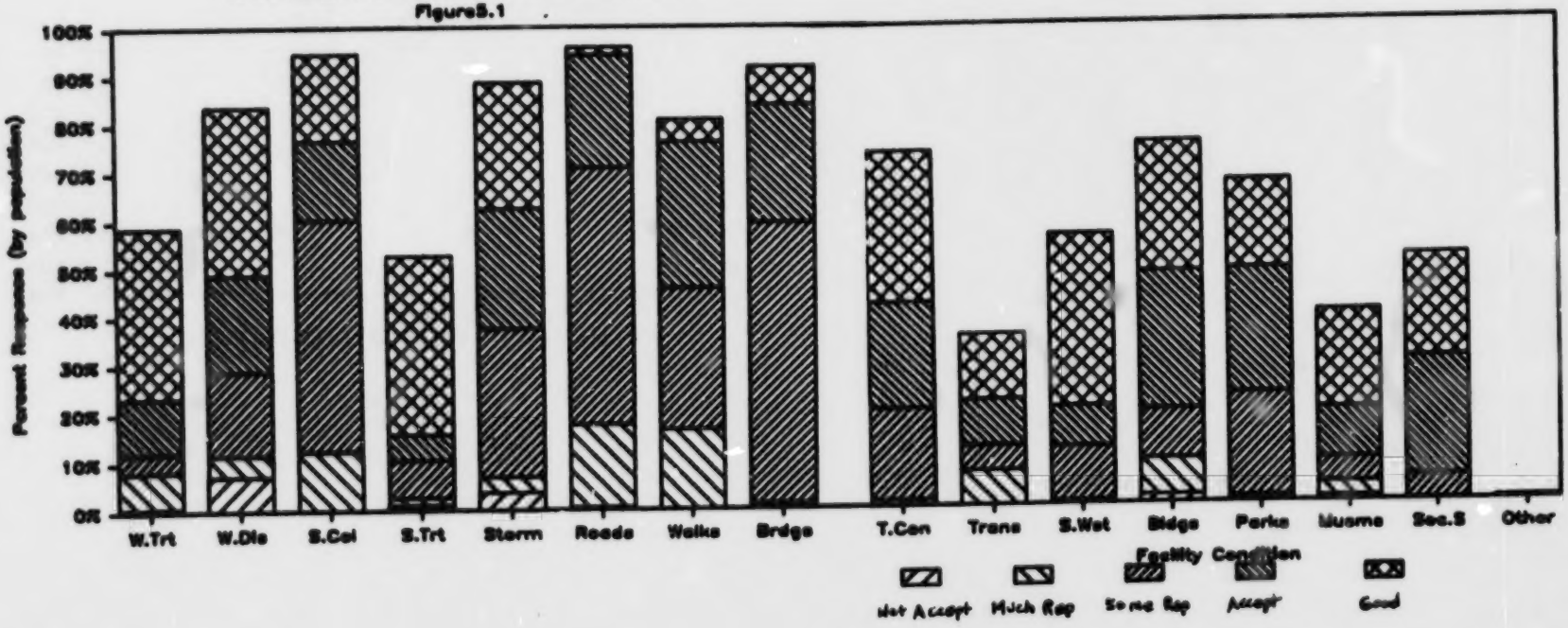
Water Treatment	W.Trt	Roads	Roads	Solid Waste	S.Wst
Water Distribution	W.Dis	Sidewalks	Walks	Pub. Bldgs.	Bldgs
Sewage Collection	S.Col	Bridges	Brdgs	Park/Rec.	Parks
Sewage Treatment	S.Trt	Traf.Control	T.Con	Cultural	Museums
Storm Sewer	Storm	Transit	Trans	Soc. Services	Soc.S

SUMMARY OF CONDITION OF INFRASTRUCTURE
Table 2.2 Percent of Population Responding — 63 Municipalities

Population 8,290,887	Age		Present Condition							Priority for Expenditure				Change in Condition			
FACILITY	Resp.	Avg Age	Resp.	good	ok	some rep.	much rep.	no good	n/a	Resp.	1st	2nd	3rd	Resp.	Better	Same	Worse
Water Treat.	57%	13	59%	36%	11%	4%	7%	1%	38%	45%	17%	12%	15%	59%	39%	16%	3%
Water Dist.	81%	25	84%	35%	20%	17%	4%	7%	14%	62%	19%	22%	21%	83%	56%	16%	12%
Sewage Coll.	92%	28	95%	18%	16%	48%	12%	0%	3%	77%	25%	26%	26%	94%	43%	35%	15%
Sewage Treat.	52%	8	53%	37%	5%	8%	1%	1%	44%	45%	33%	2%	11%	52%	49%	2%	1%
Storm Sewer	85%	18	89%	26%	25%	31%	3%	4%	7%	74%	23%	30%	21%	90%	47%	40%	4%
Roads	82%	18	96%	2%	23%	53%	17%	0%	1%	73%	31%	23%	19%	96%	21%	25%	49%
Sidewalks	72%	13	81%	5%	30%	29%	16%	0%	16%	61%	16%	14%	31%	79%	25%	25%	28%
Bridges	77%	18	92%	8%	24%	58%	1%	0%	6%	65%	22%	12%	31%	91%	37%	28%	27%
Traf.Control	62%	6	74%	32%	22%	19%	1%	0%	23%	50%	15%	17%	19%	67%	47%	19%	0%
Transit	28%	2	36%	14%	9%	5%	7%	0%	62%	29%	0%	20%	9%	36%	21%	5%	9%
Solid Waste	48%	5	56%	36%	8%	11%	0%	1%	41%	47%	10%	33%	3%	56%	34%	13%	8%
Pub. Bldgs.	66%	13	75%	27%	29%	10%	8%	2%	22%	62%	2%	33%	27%	74%	38%	33%	2%
Park/Rec.	58%	9	67%	18%	26%	21%	1%	0%	30%	60%	6%	15%	39%	67%	28%	36%	2%
Cultural	33%	6	40%	20%	10%	5%	3%	1%	58%	30%	2%	6%	22%	41%	23%	14%	4%
Soc. Services	43%	6	51%	22%	25%	5%	0%	0%	46%	41%	0%	5%	35%	46%	33%	13%	0%
Others	0%	0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

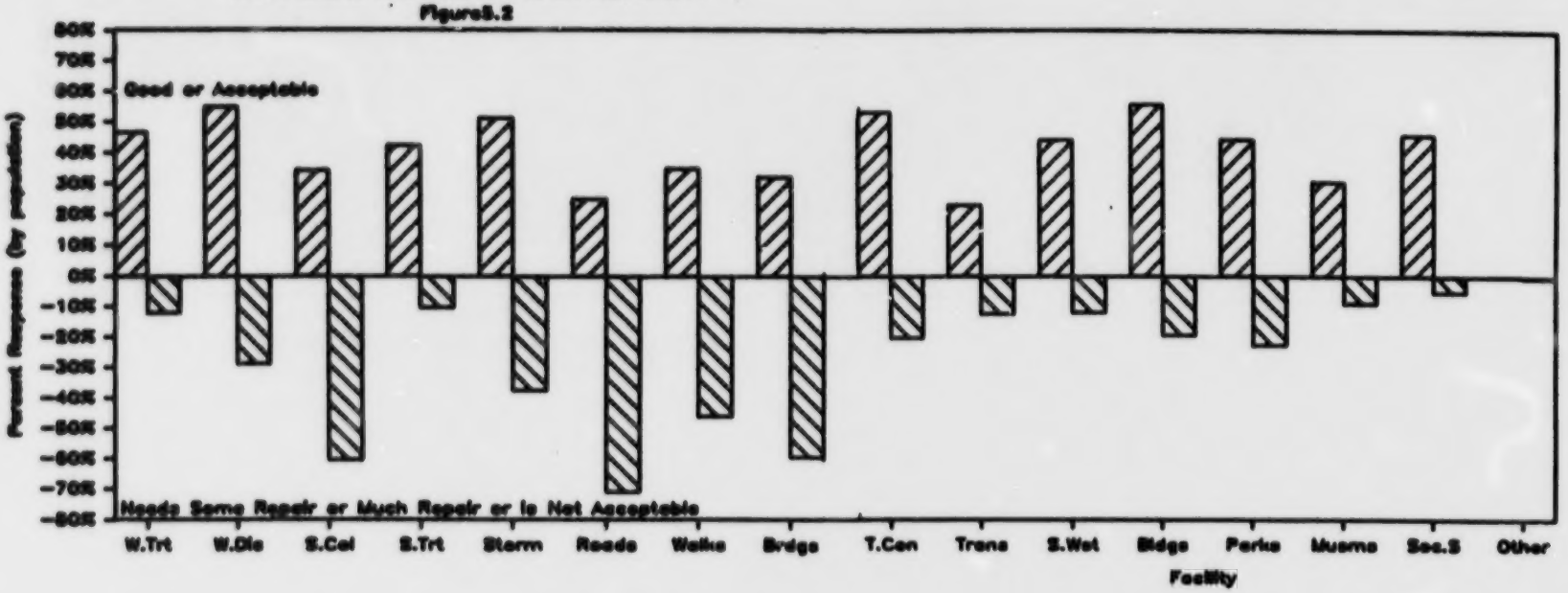
Infrastructure Condition

Figure5.1



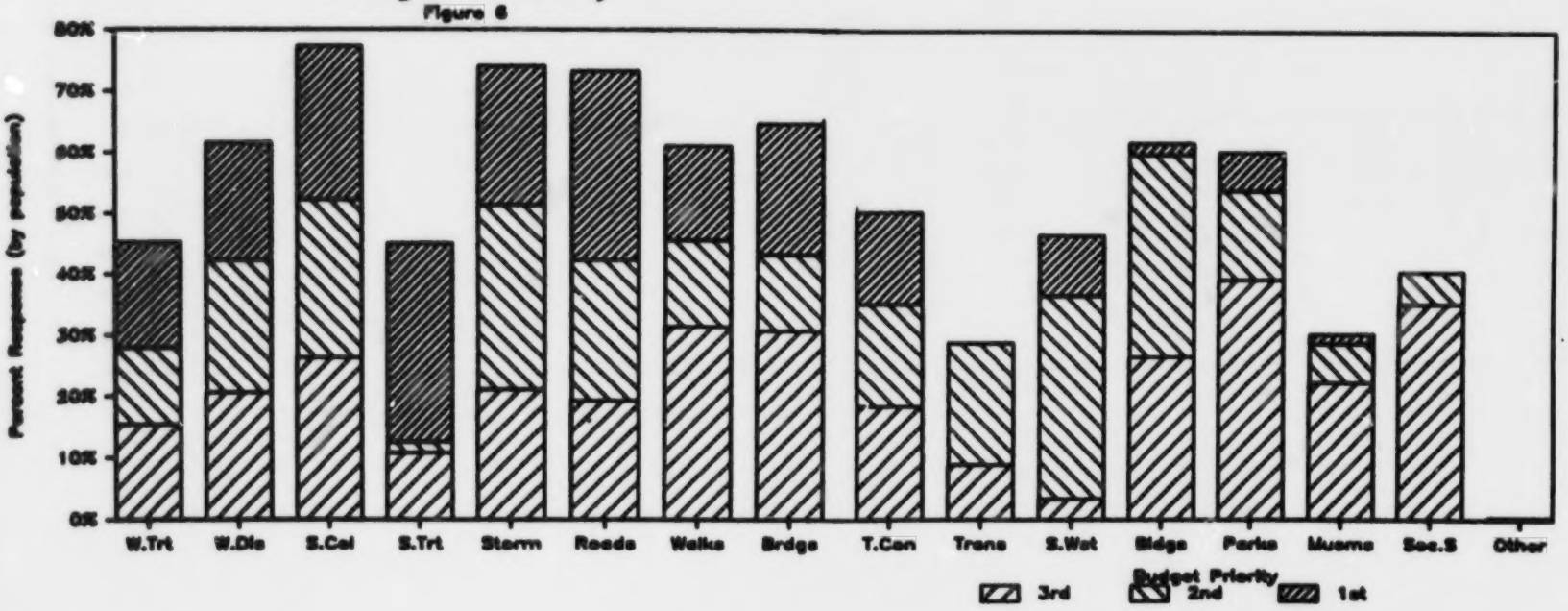
Infrastructure Condition

Figure5.2



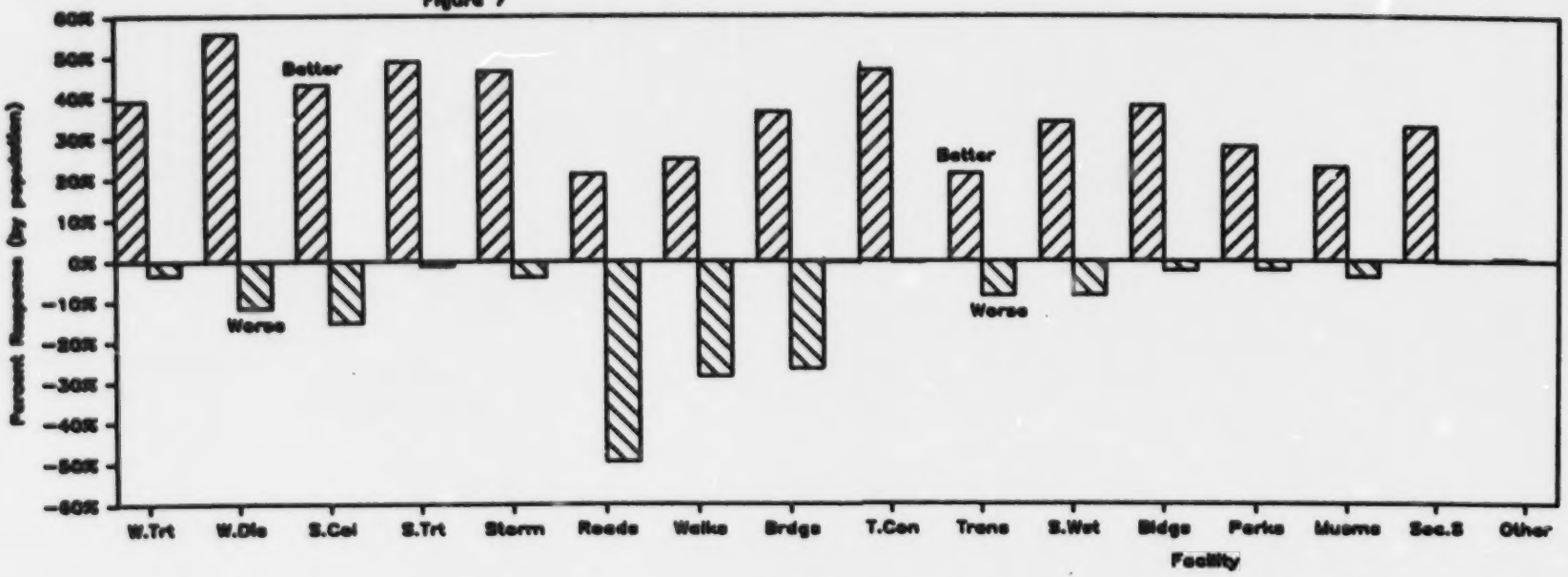
Budget Priority

Figure 6



Change in Condition

Figure 7



The following comments are made:

Age

- Most respondents completed the question of age for sewage collection systems (83%), storm sewers (78%), watermains (76%), roads (76%), bridges (63%) and sidewalks (73%). Lower responses were obtained for water treatment (59%), sewage treatment (52%), solid waste disposal (49%), as well as for several other facilities. The lower responses for these facilities could be explained by several reasons: non-existence of facility (eg sewage treatment), different level of government responsible for the service (eg. water and sewage treatment in regional/metropolitan governments), or other public officials responsible for facility (eg. parks, public buildings, transit, etc.).

- The average ages are lower than one might have expected (eg. about 20 years for roads and bridges, close to 30 years for watermains and sewers, about 20 years for storm sewers, 21 years for water treatment plants and only 11 years for sewage treatment plants).

Present Conditions (Table 2.2 and Figs. 5.1 and 5.2)

- Most respondents provided information for roads, bridges, water distribution systems, sewage collection systems, storm sewer systems and sidewalks. Lower responses were obtained for water treatment (62%), sewage treatment (54%), solid waste (57%) and several other facilities, for the possible reasons outlined above.

- Figure 5.2 plots 'good' and 'acceptable' responses above the axis, and 'needs some repair', 'needs extensive repair' and 'not acceptable' responses below the axis for easier comprehension than from Fig. 5.1.

- For most facilities poor responses are fewer and smaller than good responses.

- Roads, bridges and sidewalks are indicated as being in greatest need of repair, followed by sewers, watermains, public buildings and parks. Water treatment and sewage treatment facilities seem to be in good shape, presumably because they have a relatively young age. Most other facilities are reported in a good or acceptable state.

- It is perhaps not surprising that very few responses have been given under the category 'not acceptable', considering that the person completing the questionnaire is responsible for the service.

Priority for Expenditure (Table 2.2 and Fig. 6)

- Fewer respondents completed the information on priority ranking for capital expenditures for all facilities shown. Sewage collection systems received the highest response (67%) and transit facilities the lowest response (17%).

- There do not seem to be particular facilities with a clear consensus for budget priorities, although as a group the traditional public works facilities have a higher priority (sum of Rank 1 to Rank 3) and a much higher first priority (Rank 1 only) than do the other facilities.

- Sewage treatment facilities have the highest first priority ranking (33%), although they were given a 'good' or 'acceptable' rating under present conditions. This probably reflects the view of those communities which have no treatment facilities, or facilities with inadequate capacity, at present.

- On the basis of 1st priority only, the order of importance is: sewage treatement (33%), roads (31%), sewage collection (25%), storm sewers (23%), with all others less than 19%.

Change in Condition of Infrastructure over last 15 years (Table 2.2 and Fig. 7)

- Most respondents completed the questionnaire for roads (96%), bridges (91%), sewage collection systems (94%), storm sewers (90%), water distribution (83%), sidewalks (79%) and public buildings (74%). Fewer completions were obtained for other facilities, probably for reasons outlined earlier.

- Figure 7 indicates that, overall, the majority of respondents believe that infrastructure facilities have improved over the last fifteen years. The major exceptions are roads, where 49% of respondents believe them to have deteriorated, followed by sidewalks (28%) and bridges (27%). All other facilities had fewer than 15% of respondents rate them as being "worse".

V. 3.3 Summary of Funding - Current and Trends

Municipal Budgets

Table 3.1 presents the unadjusted budget data from the survey, in dollars of the year shown, and on a per capita basis.

PER CAPITA MUNICIPAL BUDGETS (in dollars of day)
Table 3.1 Total Survey 63 Municipalities

Population 8,290,887	Dollars per Capita (Responses) 1968	1976	1983	% of Total 1968	1976	1983
Total Budget	$241	$550	$905	100.0%	100.0%	100.0%
T. Operating	$187 (38)	$398 (50)	$711 (60)	77.7%	72.4%	78.6%
PW. Operating	$40 (37)	$77 (49)	$137 (59)	16.7%	13.9%	15.2%
T. Capital	$53 (35)	$151 (47)	$193 (59)	22.0%	27.4%	21.4%
PW. Capital	$37 (33)	$62 (45)	$99 (58)	15.4%	11.3%	11.0%
Debt	$20 (28)	$29 (41)	$52 (50)	8.2%	5.3%	5.7%

Table 3.2

Debt Charges

	Dollars per Capita		
	1968	1976	1983
Debt charges/capita			
(in $ of day)	20	29	52
(in 1983 $ CPI)	61	54	52

The following comments are made:

- It should be noted that almost all respondents provided 1983 budget figures. Those reporting on 1976 budget figures numbered in the high 40s and for 1968 in the high 30s. This variation in number of respondents over time may cause some difficulties in interpretation of funding trends after adjusting average figures to 1983 dollars.

- Two components for adjusting for inflation have been considered: The Engineering News Record Index (for Construction Costs) and the Consumer Price Index (Statistics Canada).

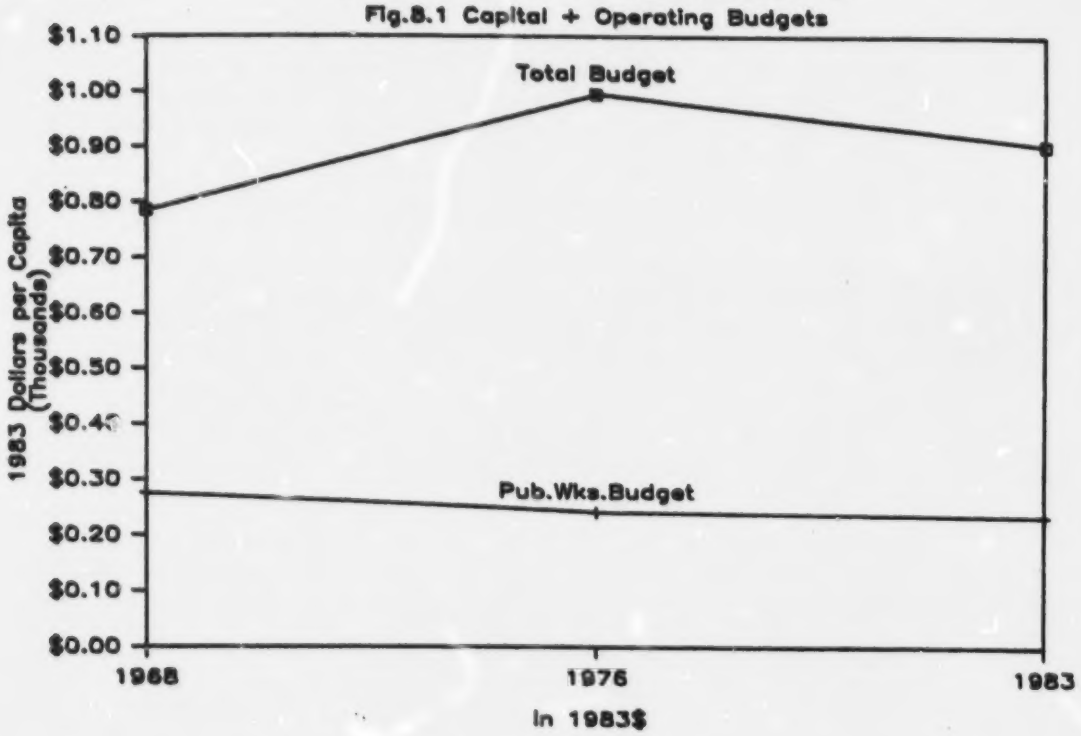
- Figure 8.1 shows the sum of the capital and operating components for both the Total Budget and the Public Works Budget in 1983$. The Total Public Works Capital and Public Works Operating Budgets were adjusted using the ENR Index. That portion of the Total Operating Budget not included in Public Works Operations was adjusted using the CP Index.

- Figure 8.2 presents data obtained from Statistics Canada on Municipal Budget Data (Annual Catalogue 68-204, 1968-1982). The sum of General Expenditures are only available up to 1980 at this time. The Total Budget is the sum of all of the components used by Statistics Canada except for Education. The Public Works Budget is the sum of the Transport and Communications Component and the Environment Component.

- It is unfortunately not possible to extract from the data on municipal budgets by Statistics Canada only those statistics which have been reported in this survey. As can be seen in Figure 8.2 the Statistics Canada lines are substantially higher than the survey data. Items such as public transit, provincial highways in urban areas, public buildings, parks and others may be included in Statistics Canada data, but are generally not included in the survey data. A further complication in comparing the two data sources occurs because the survey data are only for three specific years (1968, 1976 and 1983) and because the Statistics Canada data do not include the years after 1980. Nevertheless, it is apparent from both data sources that Public Works Budgets have decreased relative to the Total Budget.

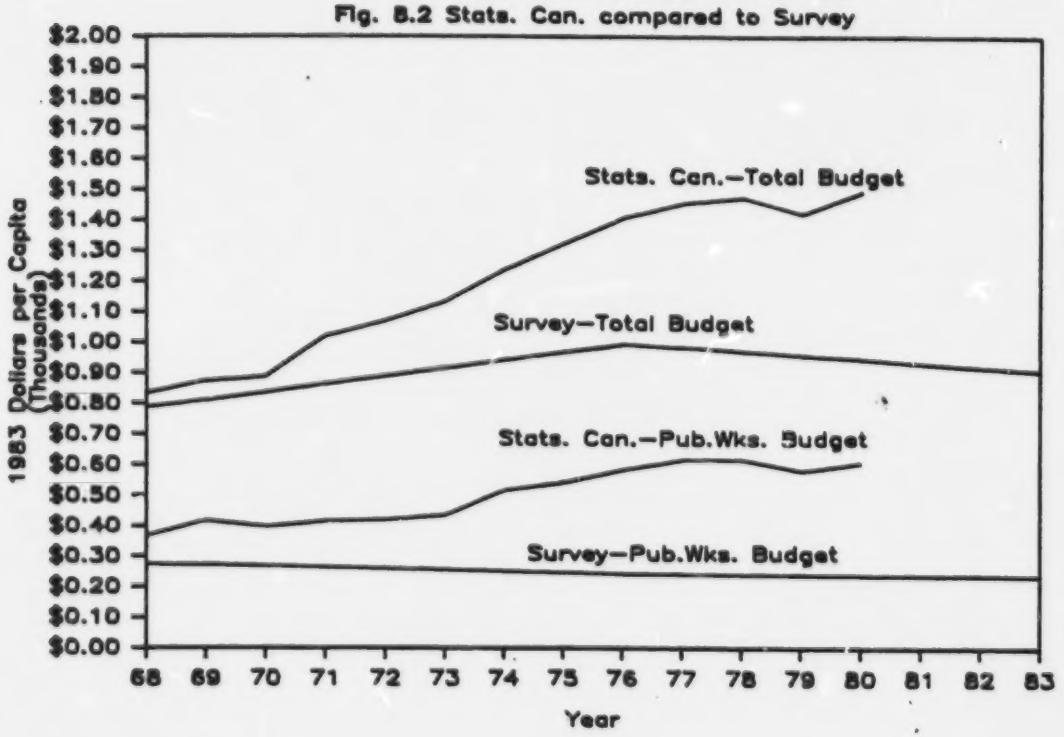
MUNICIPAL BUDGETS

Fig.8.1 Capital + Operating Budgets



MUNICIPAL BUDGETS

Fig. 8.2 Stats. Can. compared to Survey



- Debt charges on public works facilities appear to have decreased somewhat over the past 15 years to about $52 per capita per year in 1983 (Table 3.2). This represents about 6% of the total municipal budget.

Sources of Revenue for Operation, Replacement and Rehabilitation

Tables 4.1 (municipalities responding) and 4.2 (population weighted responses) provide information on the various sources of revenue for the six selected groups of facilities. Figure 9 provides the population weighted data in graphical form.

The following comments are made:

- The number of respondents to this question varied from 30 to 53 out of 63.

- User fees provide most of the funding for operation, replacement and rehabilitation of water distribution systems (86%), water treatment (83%) and sewage treatment (82%).

- General tax revenues provide the largest source of funding for roads (63%) and bridges (50%). Provincial funding is the second largest source for roads (25%) and bridges (22%).

- User fees provide the largest source of funds for sewage collection systems (54%) with general tax revenue next (30%).

- Federal funding is almost nonexistent with the slight exception of some funding for bridges (5%) and sewage treatment (1%).

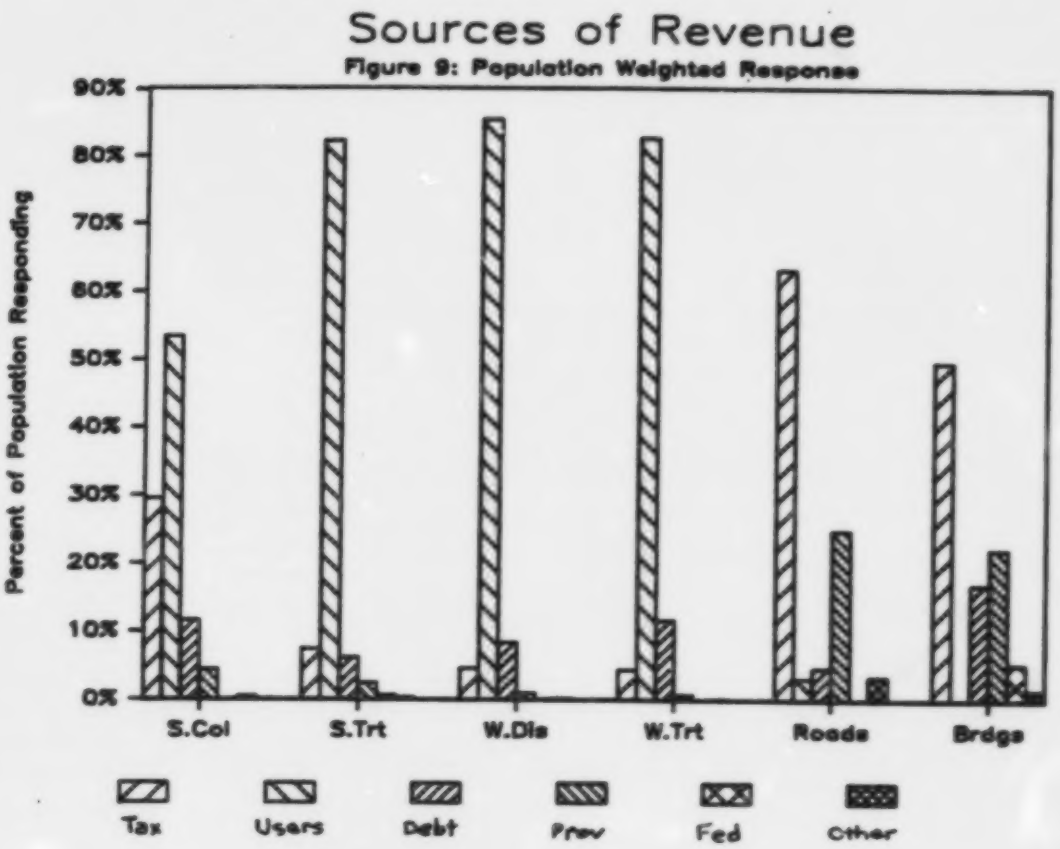
- Debt financing for facilities accounts for 5-17% of revenues, with bridges (17%), sewage collection (12%) and water treatment (12%) having the highest proportion of debt financing.

SOURCE OF REVENUE
Table 4.1 Percent of Municipalities Responding

	Sewage Collect.	Sewage Treat.	Water Distrib.	Water Treat.	Roads	Bridges
General Tax	29.6%	19.4%	15.1%	17.1%	73.6%	66.6%
User Fees	55.0%	65.7%	76.0%	74.7%	2.2%	0.0%
Debt	7.5%	5.1%	5.3%	5.4%	3.7%	8.4%
Provincial	6.6%	5.6%	3.1%	2.4%	18.4%	20.2%
Federal	.0%	1.3%	0.1%	0.0%	0.1%	1.8%
Other	1.2%	1.7%	0.6%	0.4%	2.1%	1.8%
Number	53	30	48	36	51	43
Population	7,568,811	4,257,842	6,575,011	4,638,539	7,410,585	7,053,774

SOURCE OF REVENUE
Table 4.2 Percent of Population Responding

	Sewage Collect.	Sewage Treat.	Water Distrib.	Water Treat.	Roads	Bridges
General Tax	29.6%	7.5%	4.7%	4.5%	63.3%	49.7%
User Fees	53.5%	82.3%	85.5%	82.7%	3.2%	0.0%
Debt	11.7%	6.3%	8.5%	11.8%	4.8%	17.1%
Provincial	4.5%	2.5%	1.1%	0.9%	25.0%	22.3%
Federal	.0%	0.7%	0.1%	0.0%	0.1%	5.4%
Other	0.6%	0.4%	0.2%	0.2%	3.5%	1.6%
Number	53	30	48	36	51	43
Population	7,568,811	4,257,842	6,575,011	4,638,539	7,410,585	7,053,774


Sources of Revenue
Figure 9: Population Weighted Response
Percent of Population Responding
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
S.Col
S.Trt
W.Dis
W.Trt
Roads
Bridge
Tax
Users
Debt
Prev
Fed
Other

V. 3.4 Summary of Costs and Impediments to Improvements (Infrastructure Needs)

Cost of Upgrading

Table 5.1 presents data on costs to upgrade infrastructure facilities to an acceptable level. Table 5.2 presents the costs on a per capita basis. The number of respondents for each facility and in each community size and regional category is shown in brackets. Note that in many places the number of respondents is less than 10, and in only a few places is it as high as 30. Therefore this information has to be considered to be preliminary.

The following comments are made:

- The estimated total cost per capita (Table 5.2) to upgrade the six surveyed facilities (sewage collection, sewage treatment, water distribution, water treatment, roads and bridges) to an acceptable level is $598. This compares to a 1983 capital expenditure on public works of $99 per year and $137 per year for operating expenditures (Table 3.1).

- Fig. 10.1 shows the contribution each of the six facilities makes to the total cost for upgrading. Roads accounts for the greatest contribution (about 42%), sewage collection (16%), water distribution (13%), bridges (10%) water treatment (10%) and sewage treatment (9%).

- Fig. 10.2 provides the same information but broken down by community size categories and Fig. 10.3 by region.

Impediments to Infrastructure Improvement

Tables 6.1 (municipalities responding) and 6.2 (population-weighted responses) provide information on the opinions of respondents on the relative importance of six impediments to successful rebuilding and protection of infrastructure. Figure 11.1 presents the impediment receiving the greatest response in each rank. Figure 11.2 presents all of the data in graphical form.

The following comments are made:

- Funding shortage is cited as the overwhelming impediment, 93% (population weighted) and 79% (numbers responding).

- Prolonged public involvement in the decision making process ranked second as an impediment after funding shortages in the population weighted averages. However, lack of staff for problem analysis received the most responses in the second rank showing that lack of staff is of concern particularly in the small communities.

- It is interesting to note that one third of the respondents did not reply to this question.

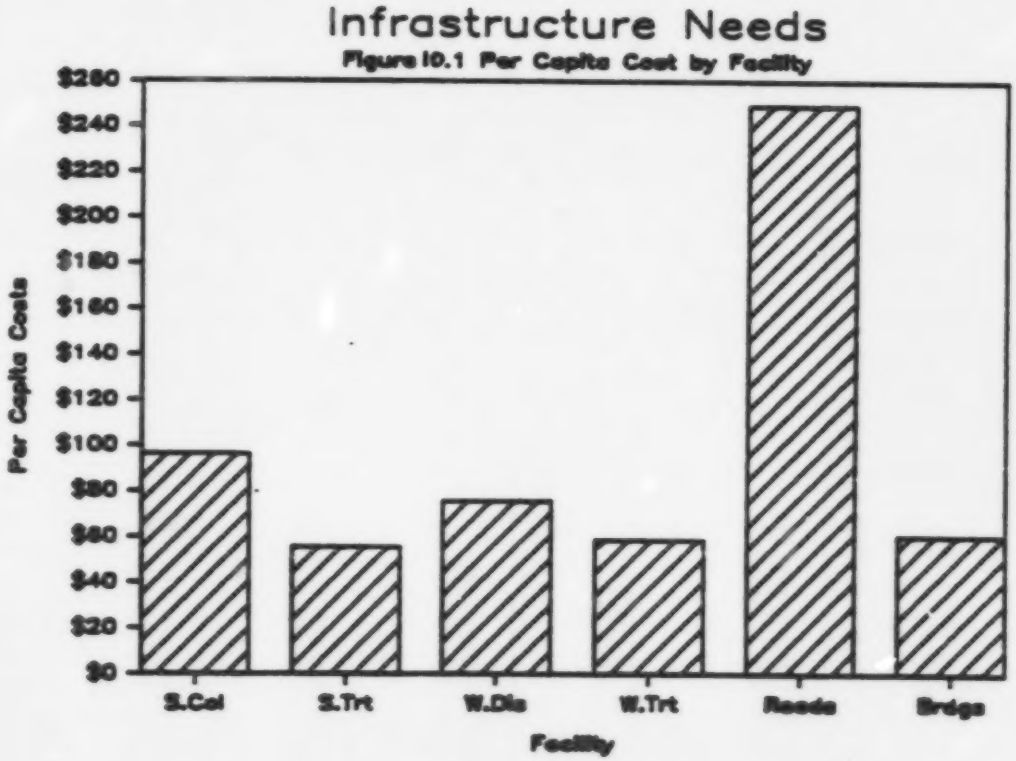
SUMMARY OF COSTS TO BRING FACILITIES UP TO AN ACCEPTABLE LEVEL

Table 5.1 43 Municipalities Surveyed

Population 4,290,887 Group	Millions of Dollars (No. of Responses) Sewage Collection		Sewage Treatment		Water Distrib.		Water Treatment		Roads		Bridges		Total
10-100,000	$154	(27)	$75	(19)	$86	(26)	$155	(21)	$487	(32)	$41	(24)	$998
100-400,000	$237	(8)	$17	(3)	$50	(6)	$21	(4)	$461	(9)	$90	(8)	$876
>400,000	$411	(7)	$371	(6)	$493	(7)	$312	(6)	$1,121	(7)	$374	(7)	$3,082
Western	$489	(20)	$287	(17)	$458	(23)	$314	(12)	$1,106	(23)	$343	(19)	$2,997
Central	$165	(13)	$169	(6)	$108	(8)	$133	(11)	$889	(20)	$161	(19)	$1,625
Eastern	$149	(9)	$6	(5)	$64	(8)	$41	(8)	$74	(5)	$0	(1)	$334
TOTALS	$802	(42)	$462	(28)	$629	(39)	$488	(31)	$2,069	(48)	$504	(39)	$4,956
PERCENT	16.2%		9.3%		12.7%		9.8%		41.8%		10.2%		100.0%

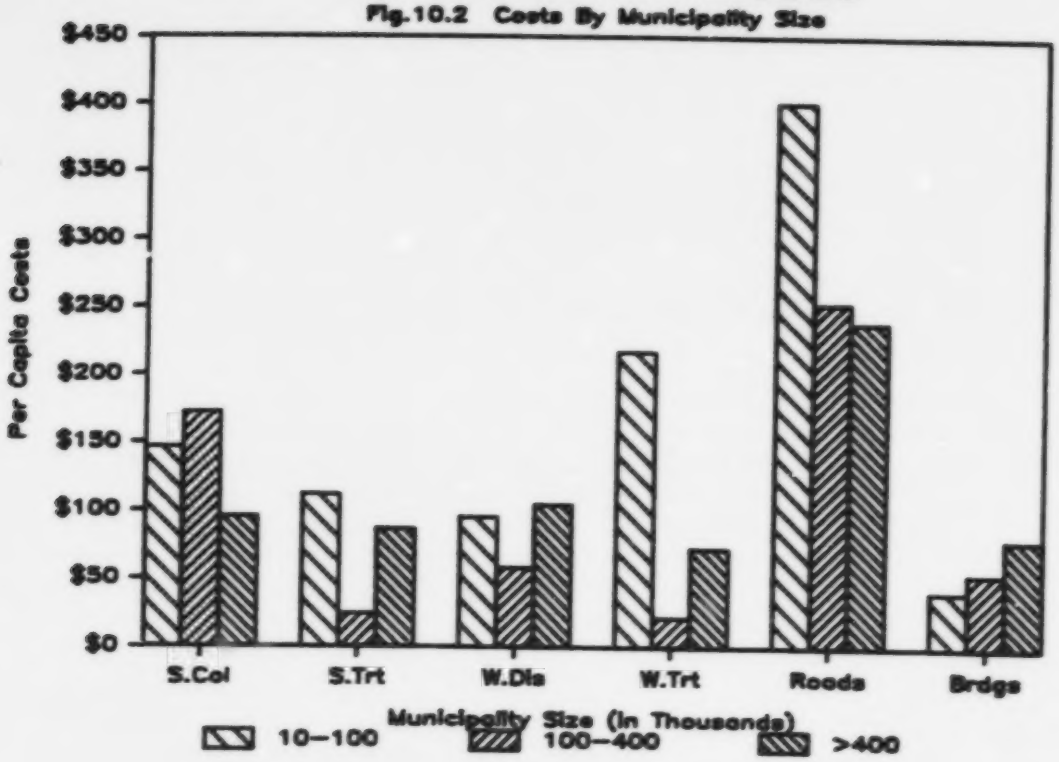
SUMMARY OF COSTS TO BRING FACILITIES UP TO AN ACCEPTABLE LEVEL
Table 5.2 63 Municipalities Surveyed

Population 8,290,887 Group	Dollars per Capita (No. of Responses) Sewage Collection		Sewage Treatment		Water Distrib.		Water Treatment		Roads		Bridges		Total
10-100,000	$147	(27)	$112	(19)	$96	(26)	$218	(21)	$402	(32)	$42	(24)	$634
100-400,000	$173	(8)	$25	(3)	$59	(6)	$22	(4)	$254	(9)	$55	(8)	$431
>400,000	$96	(7)	$87	(6)	$105	(7)	$73	(6)	$239	(7)	$80	(7)	$458
Western	$164	(20)	$122	(17)	$143	(23)	$153	(12)	$355	(23)	$119	(19)	$900
Central	$50	(13)	$55	(6)	$37	(8)	$37	(11)	$201	(20)	$37	(19)	$358
Eastern	$359	(9)	$35	(5)	$222	(8)	$142	(8)	$388	(5)	$0	(1)	$784
AVERAGE	$97	(42)	$56	(28)	$76	(39)	$59	(31)	$249	(48)	$61	(39)	$598
PERCENT	16.2%		9.3%		12.7%		9.8%		41.7%		10.2%		100.0%



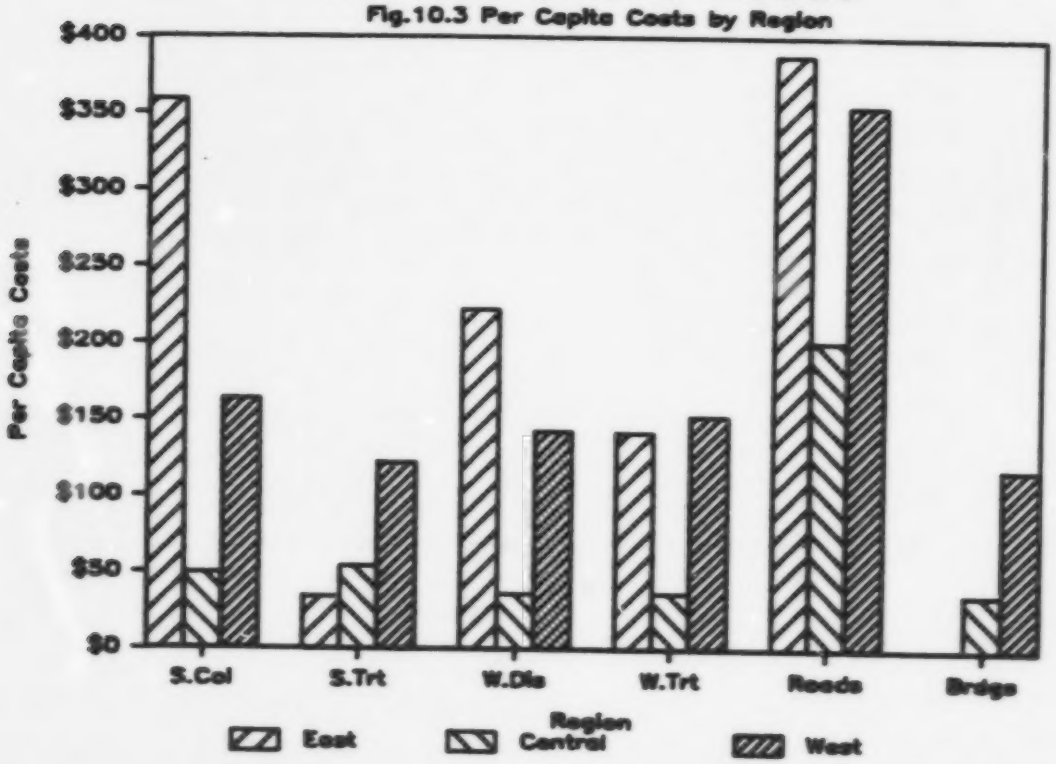
Infrastructure Needs

Fig.10.2 Costs By Municipality Size



Infrastructure Needs

Fig.10.3 Per Capita Costs by Region



IMPEDIMENTS TO INFRASTRUCTURE SOLUTIONS
Table 6.1

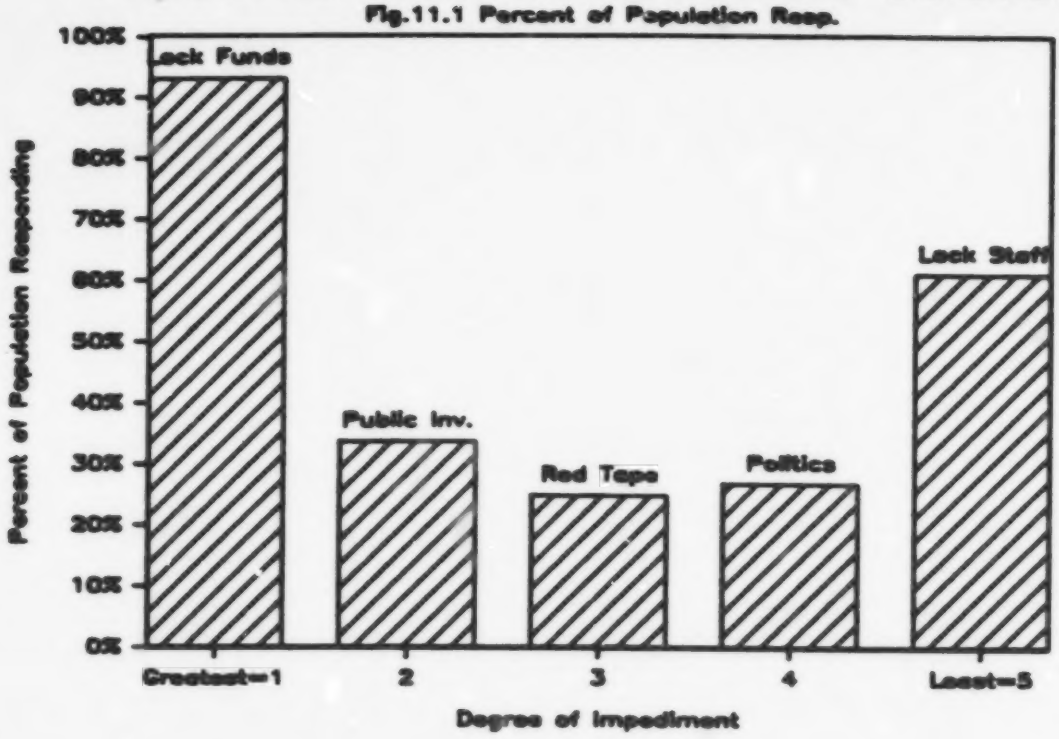
	Percent of Municipalities Responding												(Number of Municipalities)
Rank of Impediment	Funding Shortage		Public Involvement		Lack of Staff		Political Inaction		Red Tape		Other		
Greatest=1	78.6%	(33)	2.4%	(1)	7.1%	(3)	2.4%	(1)	7.1%	(3)	2.4%	(1)	
2	7.1%	(3)	14.3%	(6)	21.4%	(9)	14.3%	(6)	0.0%	(0)	0.0%	(0)	
3	7.1%	(3)	9.5%	(4)	9.5%	(4)	23.8%	(10)	23.8%	(10)	0.0%	(0)	
4	2.4%	(1)	23.8%	(10)	9.5%	(4)	23.8%	(10)	19.0%	(8)	0.0%	(0)	
Least=5	2.4%	(1)	47.6%	(20)	52.4%	(22)	35.7%	(15)	42.9%	(18)	0.0%	(0)	
Percent of Communities Responding							66.7%	(42)					
Percent of Communities Not Responding							33.3%	(21)					

IMPEDIMENTS TO INFRASTRUCTURE SOLUTIONS
Table 6.2

	Percent of Population Responding												(Number of Municipalities)
Rank of Impediment	Funding Shortage		Public Involvement		Lack of Staff		Political Inaction		Red Tape		Other		
Greatest=1	93.2%	(33)	0.2%	(1)	1.1%	(3)	0.3%	(1)	3.9%	(3)	0.2%	(1)	
2	2.2%	(3)	33.7%	(6)	9.5%	(9)	21.6%	(6)	0.0%	(0)	0.0%	(0)	
3	3.9%	(3)	6.9%	(4)	16.1%	(4)	22.4%	(10)	25.0%	(10)	0.0%	(0)	
4	0.2%	(1)	27.0%	(10)	12.1%	(4)	26.8%	(10)	21.1%	(8)	0.0%	(0)	
Least=5	0.2%	(1)	31.9%	(20)	61.1%	(22)	28.9%	(15)	39.8%	(18)	0.0%	(0)	
Percent of Population Responding							70.9%	(42)					
Percent of Population Not Responding							29.1%	(21)					

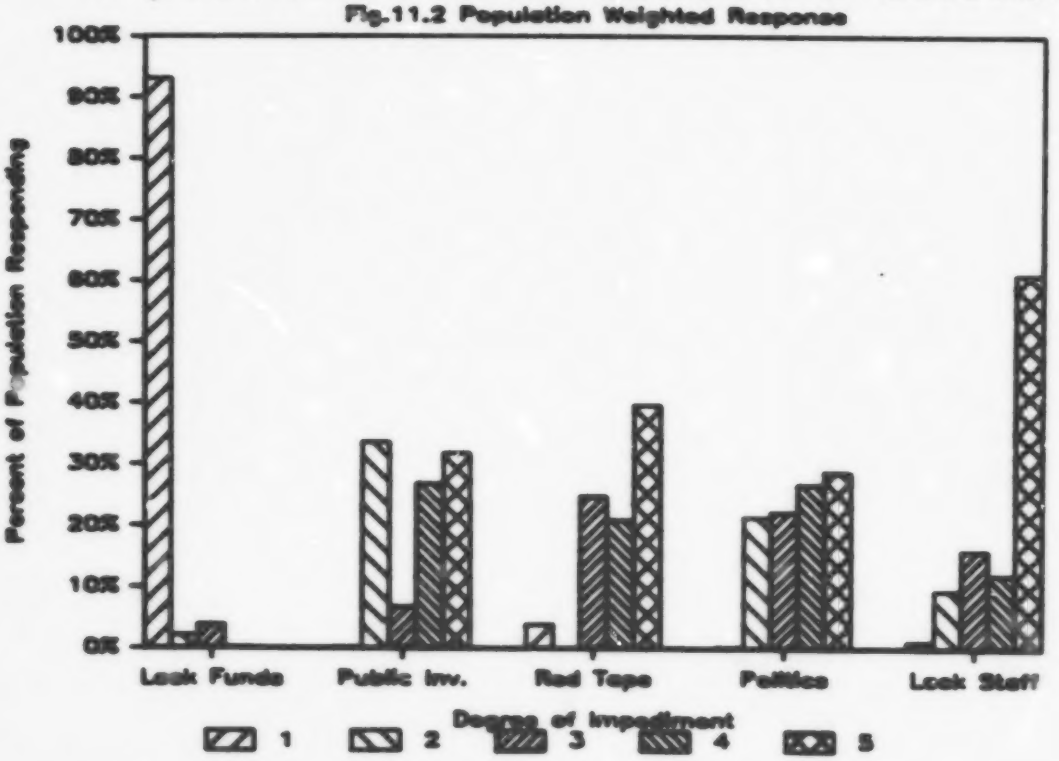
Impediments to Infrastructure Solutions

Fig.11.1 Percent of Population Resp.



Impediments to Infrastructure Solutions

Fig.11.2 Population Weighted Response



V. 3.5 Summary Data on Roads, Water Distribution and Sewage Collection

Information is presented only on three out of the six facilities surveyed in detail, namely on roads (Table 7 and Figures 12.1 and 12.2), on water distribution (Table 8 and Figures 13.1 and 13.2) and on sewage collection (Table 9 and Figures 14.1 and 14.2). The other three facilities (bridges, water treatment and sewage treatment) had fewer and less complete responses and their analysis was given a lower priority because of these reasons and because of lack of time.

The following comments are made:

Roads

- More responses were made for 1983 (25-58) than in 1976 (16-39) and in 1968(6-24) on cost data.
- On emergency repairs, liability claims and payouts, the number of responses are low even in 1983 (20-36) and are very low in 1976 (2-21) and 1968 (4-8).
- Cost figures have not been adjusted for inflation in Table 7, but have been adjusted by ENR index for the figures.
- The very high average liability payout in 1983 is caused by a $1 million claim in one city.

Water Distribution System

- More responses were made for 1983 (21-53) than for 1976 (7-31) and 1968 (2-21) on cost data.
- Only on watermain breaks has there been a reasonable response in 1983 (52) and 1976 (31). On liability claims and payouts the response is very low throughout.
- Watermain breaks, at 30 per 100 km per year, are somewhat higher than figures reported in the US and Britain at about 25 per 100 km per year.

Sewage Collection System

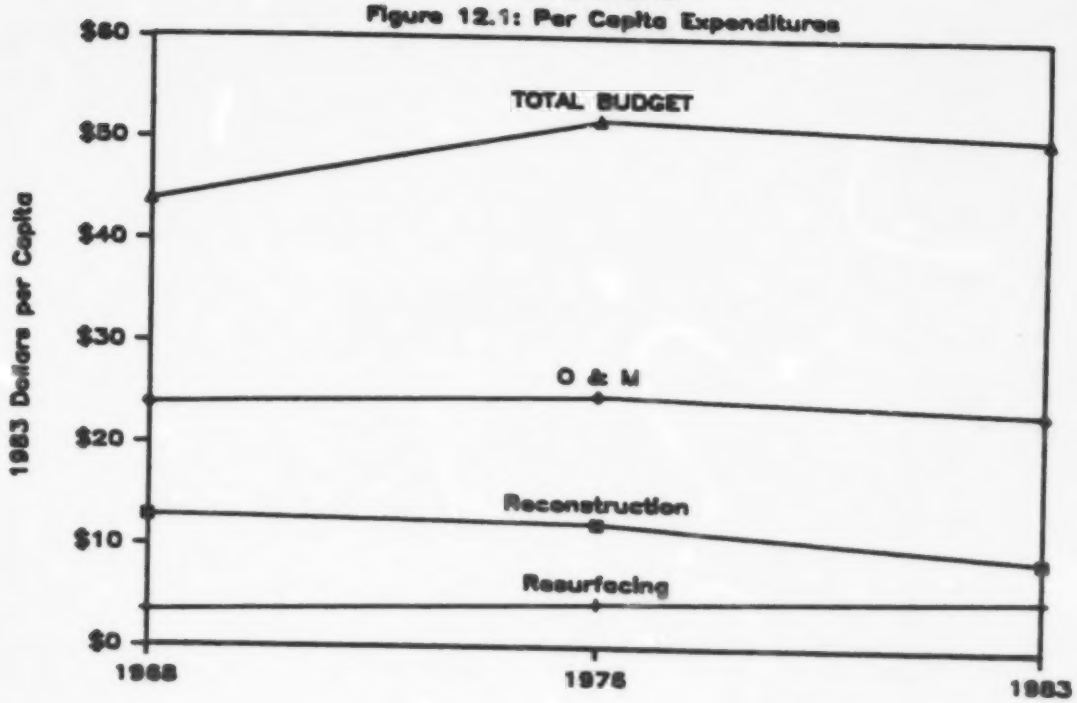
- More responses were made for 1983 (29-58) than for 1976 (16-34) and for 1968 (5-9) on cost data.
- Breaks and number of days of surcharge had a good response in 1983 (49 and 45) fewer in 1976 (24 and 24) and in 1968 (13 and 15). For liability claims and payout, only 1983 had a reasonable number of responses (28 and 29), with 1976 (9 and 10) and 1968 (4 and 5) being much lower.

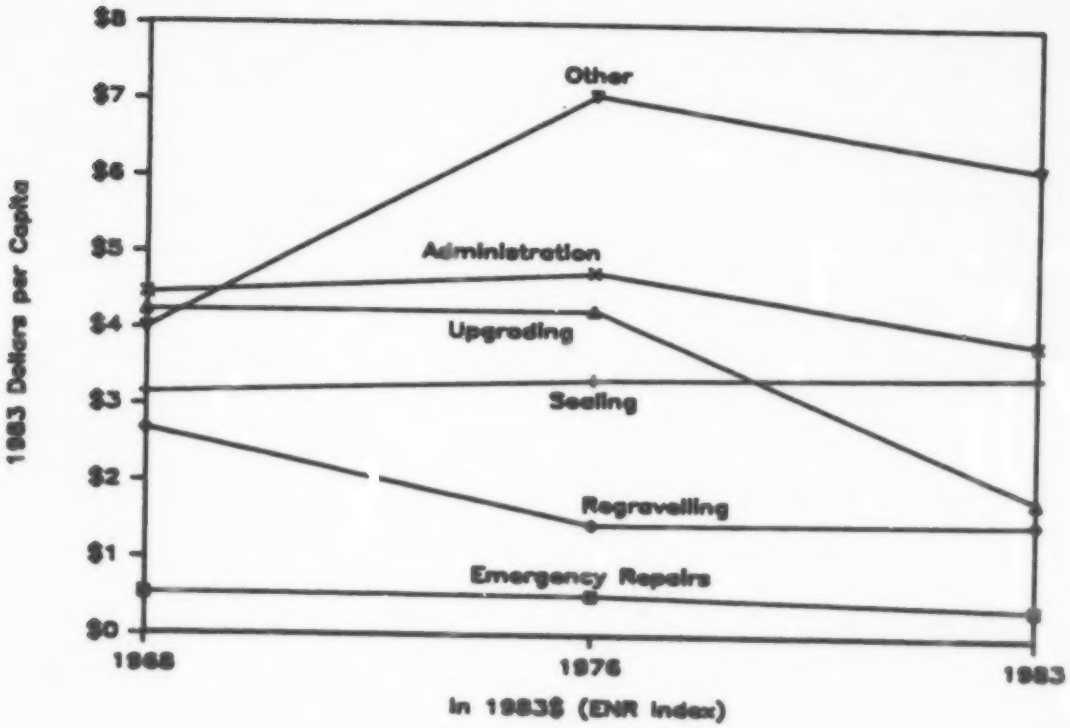
ROADS
Table 7: Per Capita Expenditures (in Dollars of the Day)

	Dollars per Capita (Responses)					
	1968		1974		1983	
Emergency Repairs	$0.15	(9)	$0.30	(17)	$0.38	(34)
Sealing	$0.89	(17)	$1.93	(30)	$3.43	(50)
Regravelling	$0.75	(16)	$0.85	(29)	$1.30	(44)
Upgrading	$1.19	(6)	$2.45	(16)	$1.80	(25)
Administration	$1.26	(17)	$2.73	(31)	$3.85	(50)
Other	$1.13	(15)	$4.06	(26)	$6.14	(38)
Reconstruction	$3.61	(15)	$6.98	(29)	$8.85	(43)
Resurfacing	$0.99	(16)	$2.47	(33)	$5.07	(47)
O & M	$6.73	(23)	$14.20	(39)	$23.31	(59)
TOTAL BUDGET	$12.35	(24)	$29.83	(39)	$50.28	(58)
	Number of Events					
Emergency Repairs (per 1000 km.)	26	(8)	95	(13)	495	(36)
Claims per million	297	(4)	260	(12)	199	(21)
Payouts(per 1000)	$37	(4)	$345	(9)	$20,511	(20)

ROADS

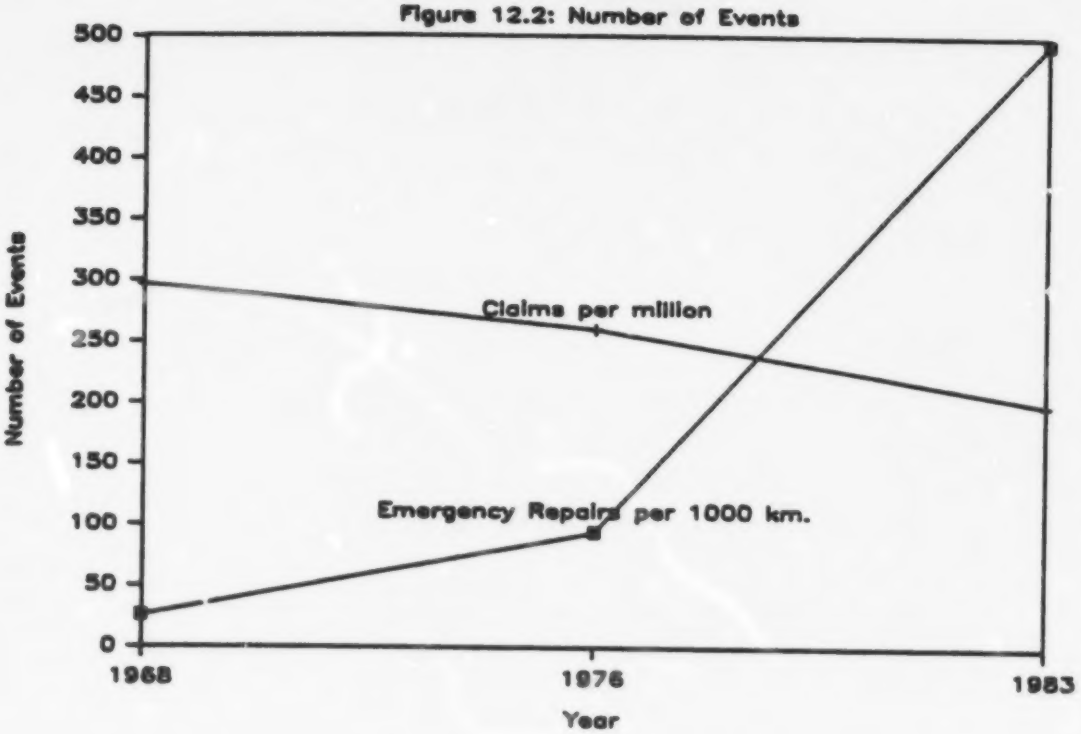
Figure 12.1: Per Capita Expenditures





ROADS

Figure 12.2: Number of Events

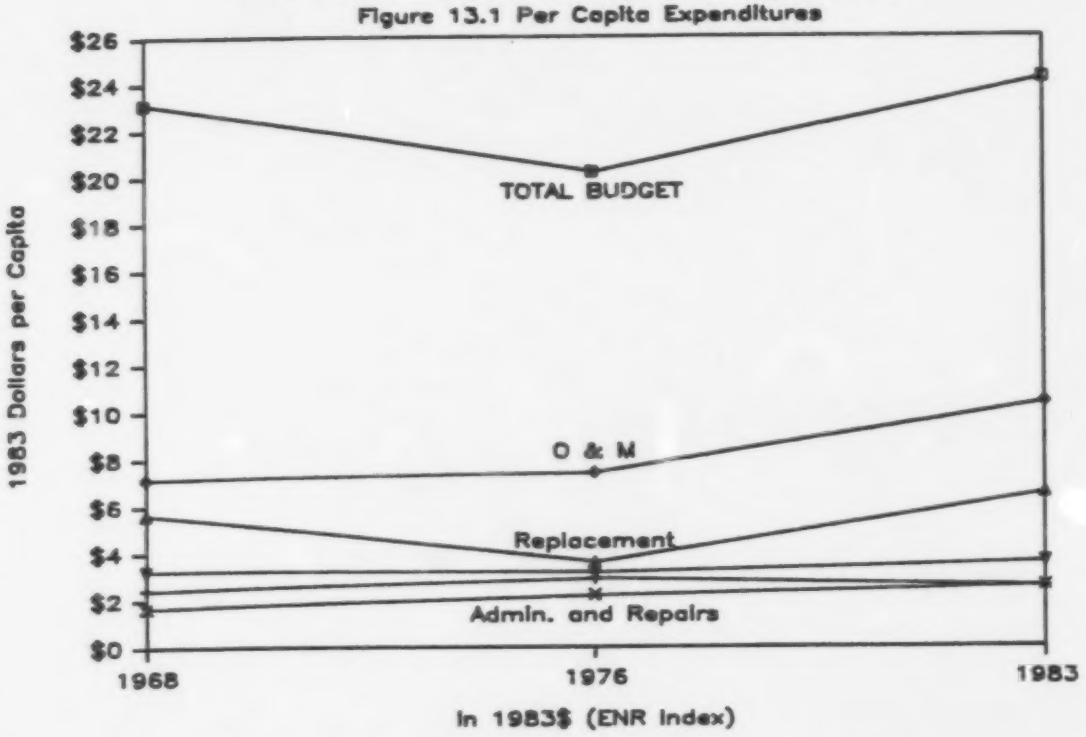


WATER DISTRIBUTION SYSTEM
Table 8: Per Capita Expenditures (Dollars of the Day)

	Dollars per Capita					
	1968		1976		1983	
Emerg. Repairs	$0.91	(11)	$1.84	(15)	$3.63	(36)
Sched. Repairs	$0.47	(2)	$1.29	(7)	$2.60	(21)
Replacement	$1.59	(7)	$2.08	(16)	$6.56	(37)
O & M	$2.02	(16)	$4.27	(25)	$10.40	(47)
Administration	$0.69	(15)	$1.69	(23)	$2.36	(46)
TOTAL BUDGET	$6.30	(21)	$11.61	(31)	$24.21	(53)
	Number of events					
Breaks/100km	16.6	(18)	30.0	(31)	30.4	(52)
Claims per million	140	(3)	129	(7)	131	(17)
Payouts($/1000)	$58	(2)	$40	(5)	$403	(16)

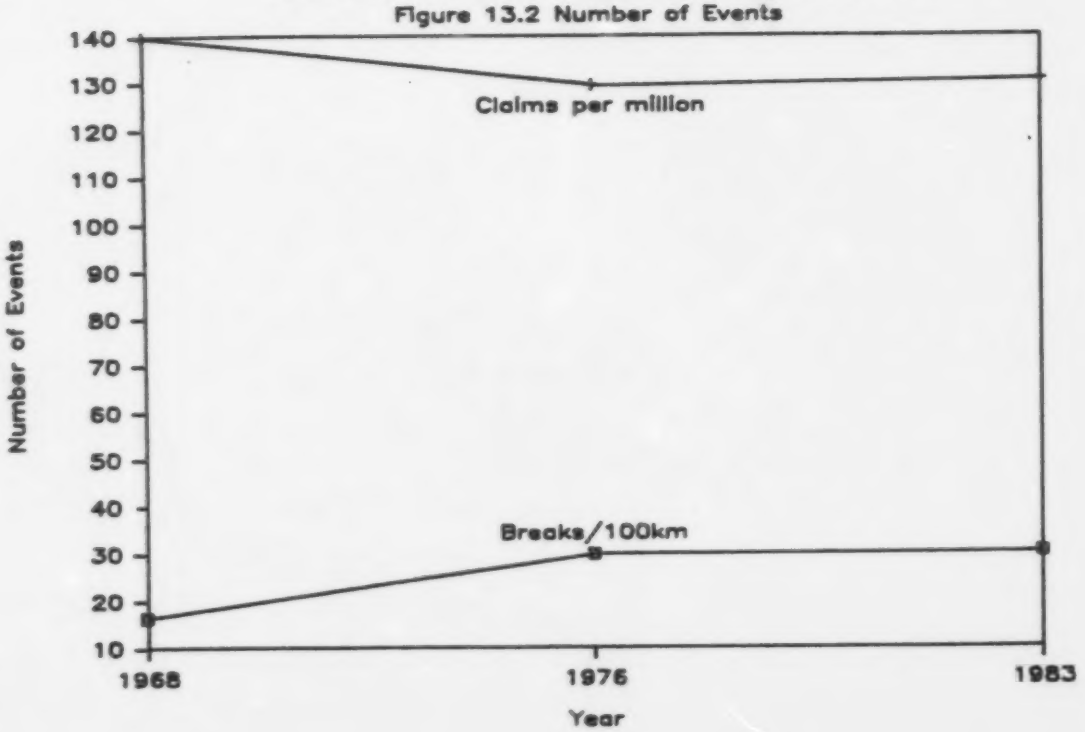
Water Distribution System

Figure 13.1 Per Capita Expenditures



Water Distribution System

Figure 13.2 Number of Events



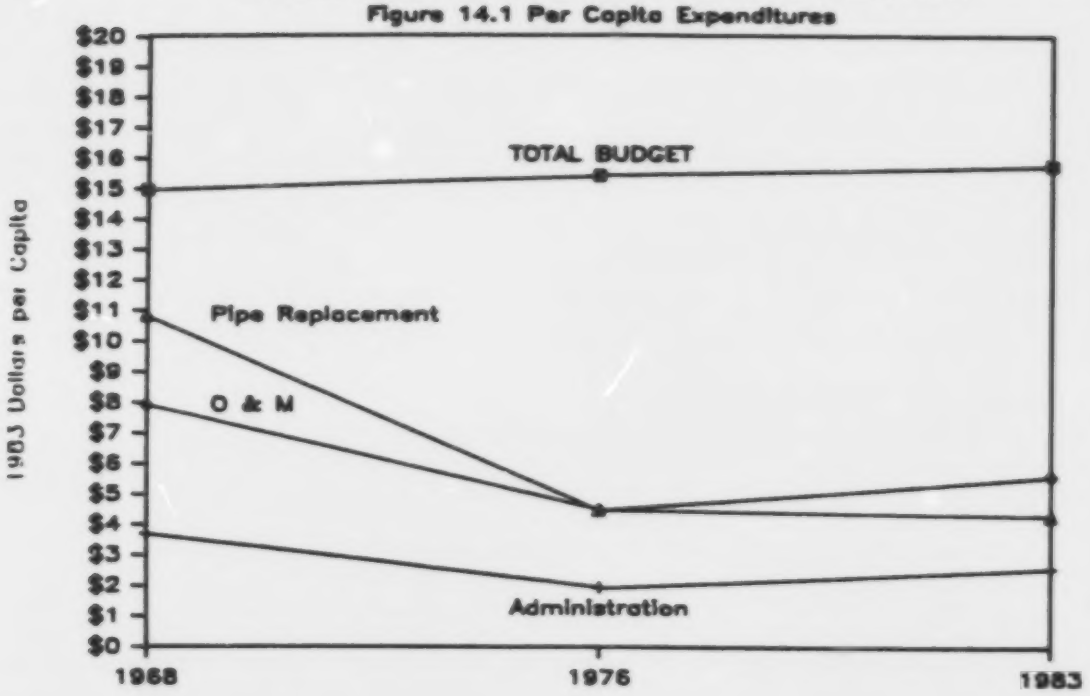
SEWAGE COLLECTION SYSTEM
Table 9: Per Capita Expenditures

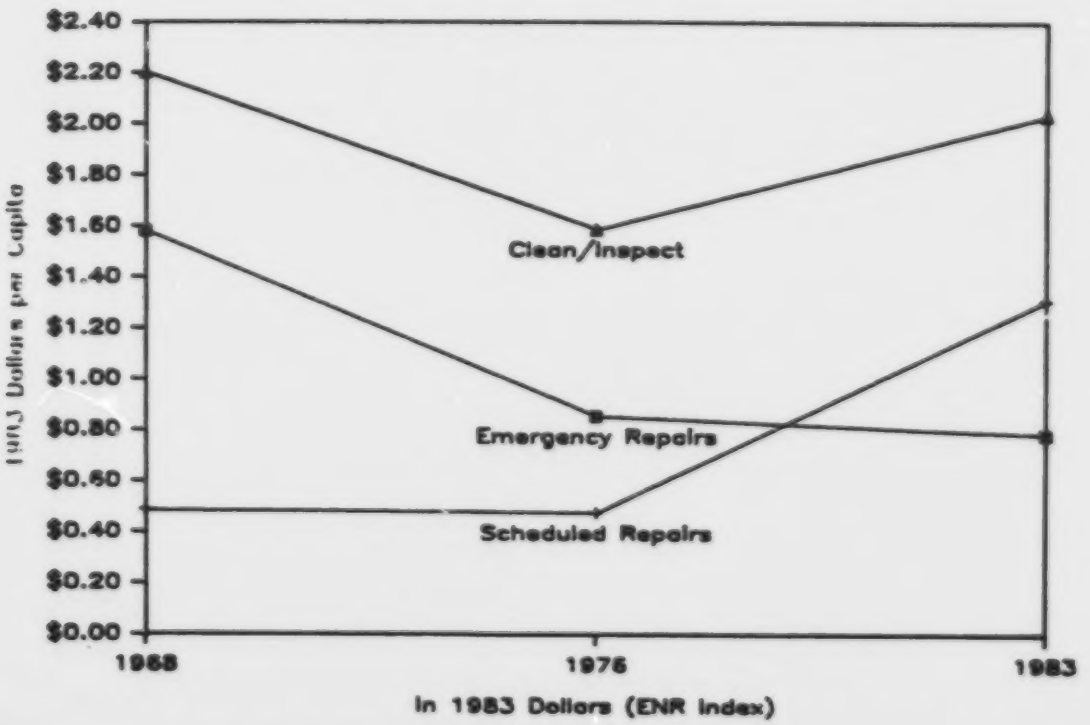
	Dollars per Capita (Responses)					
	1968		1976		1983	
Emergency Repairs	$0.44	(14)	$0.49	(24)	$0.78	(42)
Scheduled Repairs	$0.14	(10)	$0.27	(16)	$1.31	(29)
Pipe Replacement	$3.05	(5)	$2.58	(16)	$4.30	(33)
Clean/Inspect	$0.62	(13)	$0.91	(25)	$2.04	(50)
O & M	$2.23	(12)	$2.57	(24)	$5.61	(49)
Administration	$1.04	(12)	$1.12	(26)	$2.60	(50)
TOTAL BUDGET	$4.21	(19)	$8.86	(34)	$15.77	(58)
	Number of Events					
Breaks/100 km	5.6	(13)	7.1	(24)	17.1	(49)
Days Surcharged*	59	(15)	76	(24)	91	(45)
Liability Claims*	91	(4)	100	(9)	108	(28)
Payouts($/1000)	$14	(5)	$47	(10)	$144	(29)

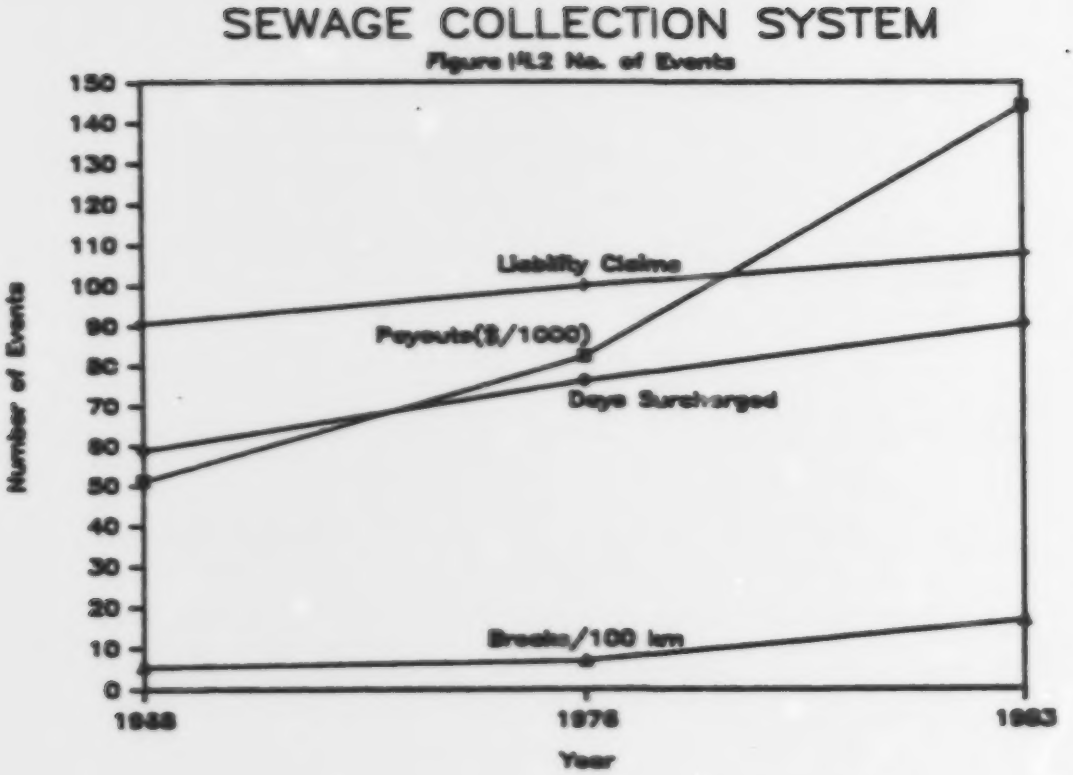
* Per Million Population

SEWAGE COLLECTION SYSTEM

Figure 14.1 Per Capita Expenditures






SEWAGE COLLECTION SYSTEM
Figure IL2 No. of Events
Number of Events
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Liability Claims
Payouts($/1000)
Days Surcharged
Breaks/100 km
1968
1976
1983
Year

V. 3.6 Comparison of the Canadian Survey Results with the U.S. Experience

The most similar published study to this Canadian survey is the National League of Cities and United States Conference of Mayors (NLC-USCM) study conducted in early 1983. It is based on 809 responses out of a total 1400 U.S. communities surveyed. Comparison between the two studies are made for infrastructure condition, budget priority and a cross-correlation between condition and priority. Such data were presented in tabular form only in the NLC-USCM study, but have been graphed here to facilitate comparison with the Canadian experience.

Infrastructure Condition

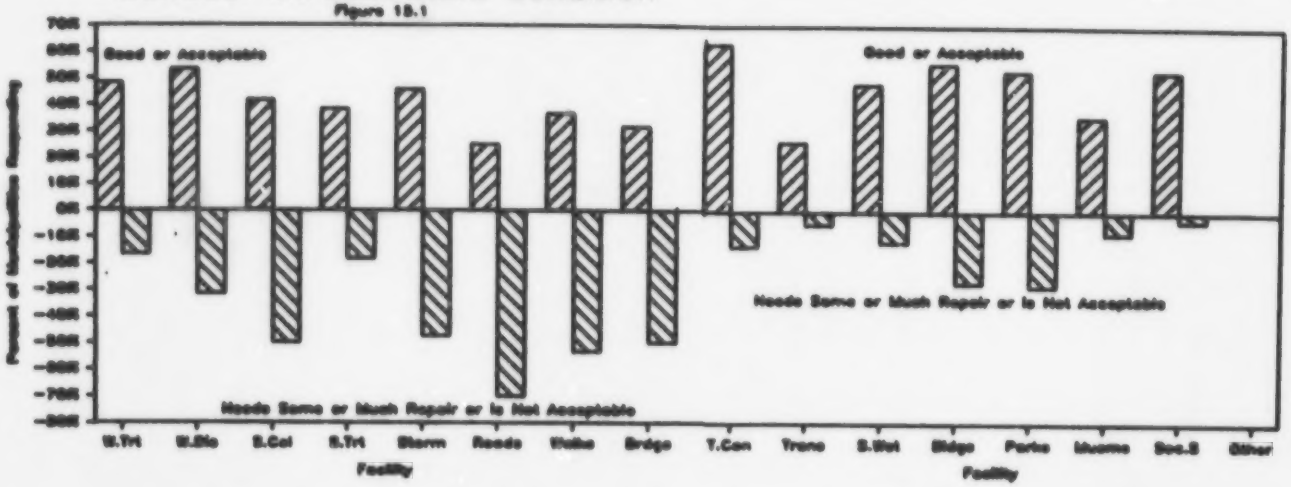
Figures 15.1 and 15.2 show the respective information on Infrastructure Conditions for the Canadian survey (on top) and the U.S. (on bottom). Note that the Canadian figures are similar to those shown in Figure 5.2, but here they are based on percent response of number of communities, whereas Figure 5.2 is a population weighted graph. This is done to provide comparison to the available U.S. figures.

The categories of condition were as follows in the two surveys:

Canadian Study		U. S. Study	
1	in good condition	1	in good condition
2	in acceptable condition		
3	needs some repair	2	needs major repairs
4	needs extensive repair	3	needs major rehabilitation
5	is not acceptable	4	needs replacement

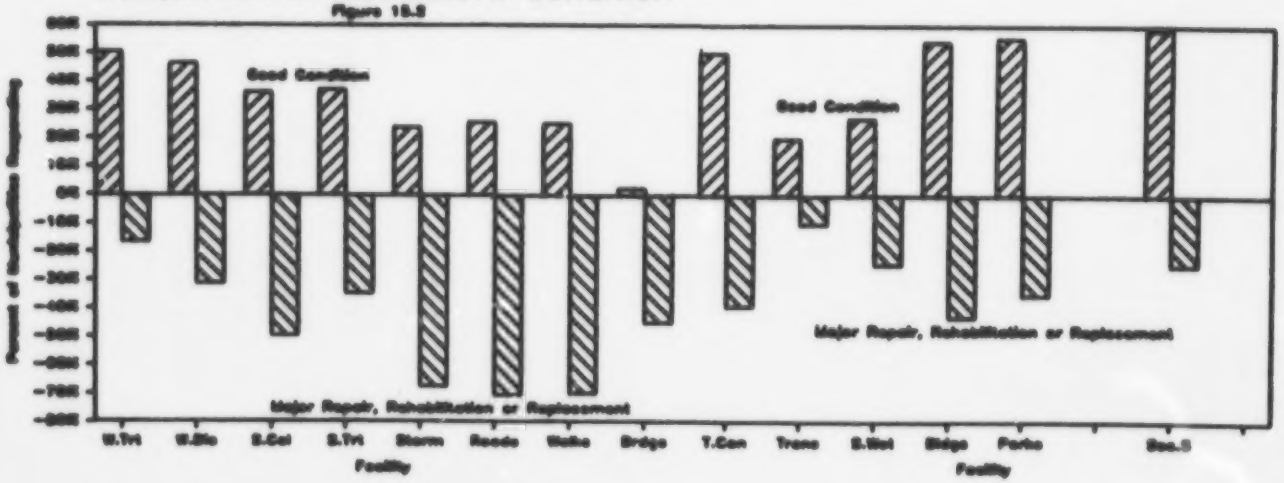
Canada: Infrastructure Condition

Figure 15.1



NLC,USCM: Infrastructure Condition

Figure 15.2



The differences in wording of the question and in the number of categories makes it necessary to decide on equivalence of categories. It can be seen that the U.S. survey does not have a category "acceptable" or "needs some repair". It is believed that the equivalence shown above is the only possible choice to be made for comparative purposes. However, it is also believed that the chosen categories and wording overemphasizes the negative responses (major repair, major rehabilitation and replacement) in the U.S. survey.

The following comments can be made:

- Canada's infrastructure appears to be in much better condition than that of the U.S. However, this conclusion may be influenced by the overemphasis on the negative categories in the US survey, as discussed above.

- The facilities judged to be in poorest condition are the same in both countries: roads, bridges and sidewalks and both storm and sanitary sewers.

Budget Priority

Figures 16.1 and 16.2 show the respective information on budget priority for the Canadian Survey (on top) and the U.S. Survey (on bottom). In the U.S. survey respondents were asked to choose only their top three budget priorities, in the Canadian survey respondents were only asked to rank their budget priorities from 1 to 3. Therefore, a direct comparison of highest total bars cannot be made.

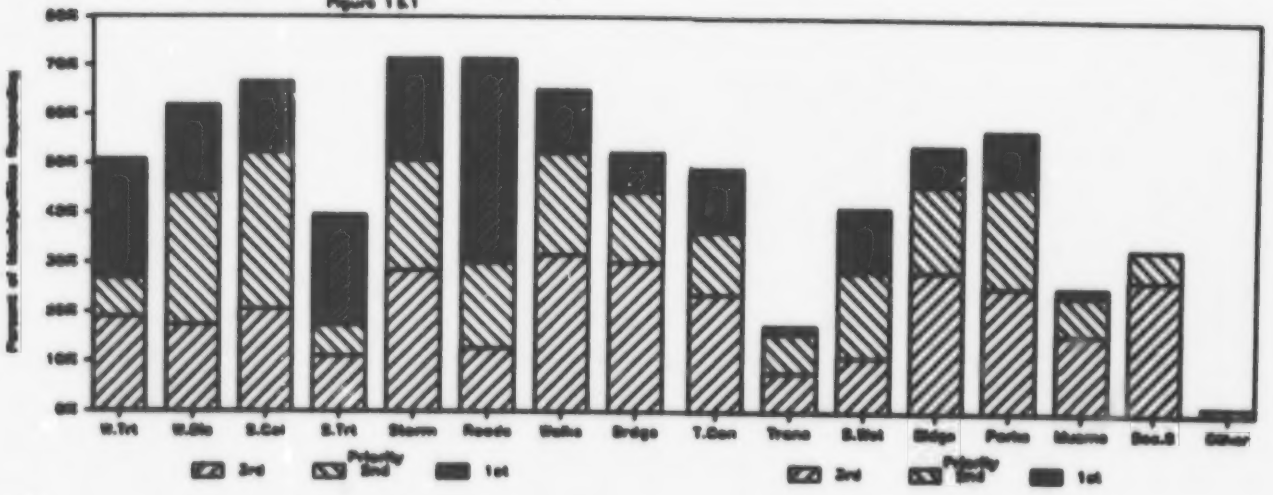
However, the following comments are possible:

- In both countries roads are clearly ranked as the first priority by the largest number of respondents.

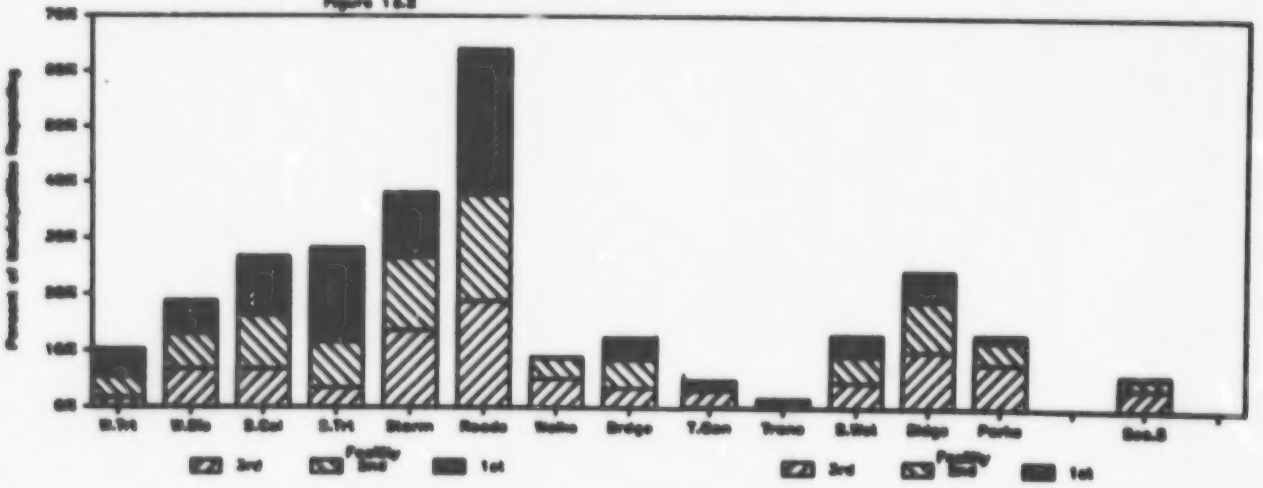
- The next group in the first priority category, in order, includes storm sewers, sewage treatment and sewage collection, of about the same number of respondents for each.

- Comments on other facilities are difficult to make since the respondent in the U.S. survey had only three facilities to choose for 1st, 2nd and 3rd priority, thereby giving no or low responses for facilities shown on Figure 16.2.

Canada: Budget Priority



NLC,USCM: Budget Priority



Top Budget Priority Versus Condition of Infrastructure

It may be expected that those facilities which are judged to be in poor condition should have a very high budget priority. Such information has been plotted in Figure 17.1 for Canada and Figure 17.2 for the U.S. The warning about the danger of direct comparison made earlier for condition and for priority applies here as well.

- In Canada (Figure 17.1) roads have the highest response for top budget priority and are judged to be most in need of repair. Others (storm sewers, sewage collection and water distribution) follow the expected pattern more or less. Water treatment and sewage treatment have a higher priority than expected from the condition judgement, perhaps resulting from the need for expansion rather than for upgrading. Sidewalks have a relatively low priority in spite of being judged only second to roads in need of repair, indicating that they may not be as essential a service in the minds of the respondents as other facilities. Parks and traffic control facilities appear to have a higher budget priority than expected from condition judgements, perhaps because of being high on the public's list of priorities.

- Similar comments can be made about the internal consistency of the U.S. survey (Figure 17.2). A few highlights are: Roads hold top position in budget priority and in need assessment. Sidewalks, on the other hand, rate less than 1% in the budget priority, although their condition is judged to be as bad as roads.

- Because of the problems outlined earlier in the differences in the questions asked, a direct comparison of percent response for each facility, is not possible.

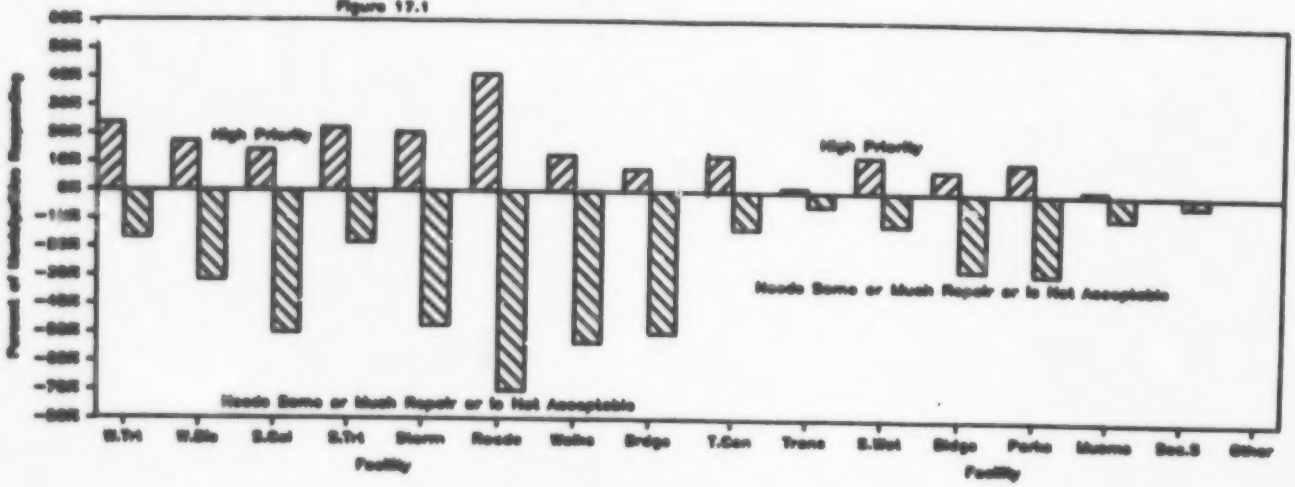
V. 3.7 National Projections from Survey Results

In Canada there are 33 cities with populations greater than 100,000. The total population of these cities is 9,190,000. The overall response to the survey includes 18 cities with populations greater than 100,000 and whose total population is 5,840,000, which represents 64% of the Canadian population in cities of this size. However, not all of these respondents provided estimates of the costs required to bring their facilities up to an acceptable level. The number of responses received in each of the six categories surveyed is as follows:

Responses Total	-18
Responses on Roads	-16
Responses on Bridges	-15
Responses on Sewage Collection	-15
Responses on Water Distribution	-13
Responses on Water Treatment	-10
Responses on Sewage Treatment	- 9

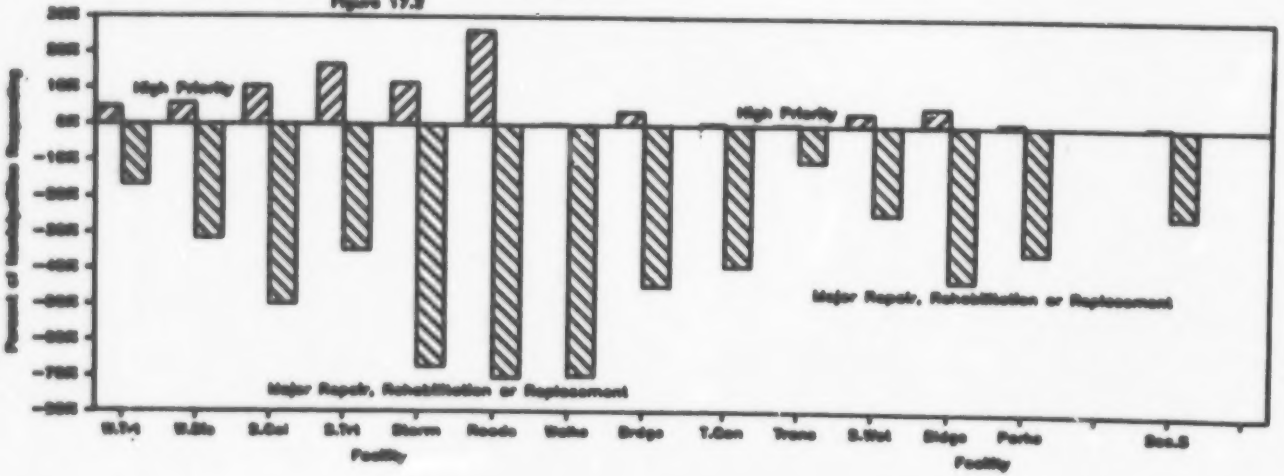
Canada: Priority vs. Condition

Figure 17.1


High Priority
High Priority
Roads Some or Much Repair or is Not Acceptable
Roads Some or Much Repair or is Not Acceptable
Facility
Facility

NLC,USCM: Priority vs Condition

Figure 17.2



The following projections are made on the assumption that the needs for the cities responding are typical for all cities in Canada with populations greater than 100,000.

The total cost for all Canadian cities over 100,000 population to bring the six facilities included in the survey (Sewage Collection and Treatment, Water Distribution and Treatment, Roads and Bridges) up to acceptable standards is approximately 5.3 billion dollars. If this situation is to be overcome in the next 10 years, at least 530 million dollars per year must be spent in addition to current public works expenditures. Approximately 50% of this amount is required for roads and bridges and 20% for sewage collection systems.

In 1983, the municipal budgets of these communities show the following expenditures:

Total Expenditures (both Capital and Operating)	8.3 Billion dollars
Public Works Expenditures (both Capital and Operating)	2.2 Billion dollars or 26%

An addition of 530 million dollars per year to the present public works budget represents an increase of 22%.

Presently 63% of road expenses, 50% of bridge expenses and 30% of sewage collection expenses are funded from general tax revenue. Other significant revenue sources for roads and bridges include provincial subsidies and debt financing. For sewage collection, user fees provide a large portion of revenue.

If all revenue sources were to be increased in proportion to their current contribution, then just to meet the needs of roads, bridges and sewers (70% of the total needs) would require an increase of 200 million dollars per year in general taxes. This is approximately 22 dollars per capita. The remainder of the 530 million would have to be raised in increased user fees, provincial and federal subsidies and increased debt. This assumes that there would not be a massive federal or provincial funding increase specifically directed at the urban infrastructure renewal.

There were survey responses from only 42 of the 312 Canadian municipalities with populations between 10,000 and 100,000. Of these the number of responses to the specific question on cost required to bring the facilities to an acceptable level ranges from 32 for roads to 19 for sewage treatment. For this reason no estimates of national costs have been made for cities with populations less than 100,000.

V. 3.8 Summary of Survey Conclusions

On the basis of this Phase I survey, the following can be concluded:

1. many of the Canadian municipal infrastructure systems are perceived to already be in poor condition (Figure 5) and are deteriorating (Figure 7). Roads, bridges, sewage collection and sidewalks are perceived to be in the worst condition. Roads, sidewalks and bridges have deteriorated the most over the last 15 years.

2. the condition of the Canadian municipal infrastructure system is better than the condition of the infrastructure in the United States (Figure 15). In both countries, roads, bridges and sidewalks are in the poorest condition.

3. the current condition as measured by the number of emergency repairs for roads, and breaks for the sewer and water systems shows a deteriorating condition.

4. the state of disrepair of the infrastructure is evidenced by the $598 per capita cost to upgrade to acceptable levels (Figure 10) which is composed of the following:

   i) $249 per capita for roads;
   ii) $153 per capita for sewer collection and treatment;
   iii) $135 per capita for water distribution and treatment;
   iv) $ 61 per capita for bridges.

5. funding shortage is overwhelmingly the greatest impediment to the successful rebuilding and protection of the municipal infrastructure (Figure 11). Public involvement is next.

6. over the past fifteen years, the municipal budgets for both public works operations and capital have diminished as a percent of the total municipal operations and capital budgets (Figure 8). The Public Works budget has decreased in terms of constant 1983 dollars.

7. sources of revenue for the operation, replacement and rehabilitation of specific infrastructure systems vary depending on the system (Figure 9). All revenue sources are considered important.

8. The order of importance for budget priority is sewage treatment, roads, sewage collection, storm sewers and bridges (Figure 6).

VI. FEDERAL TRENDS

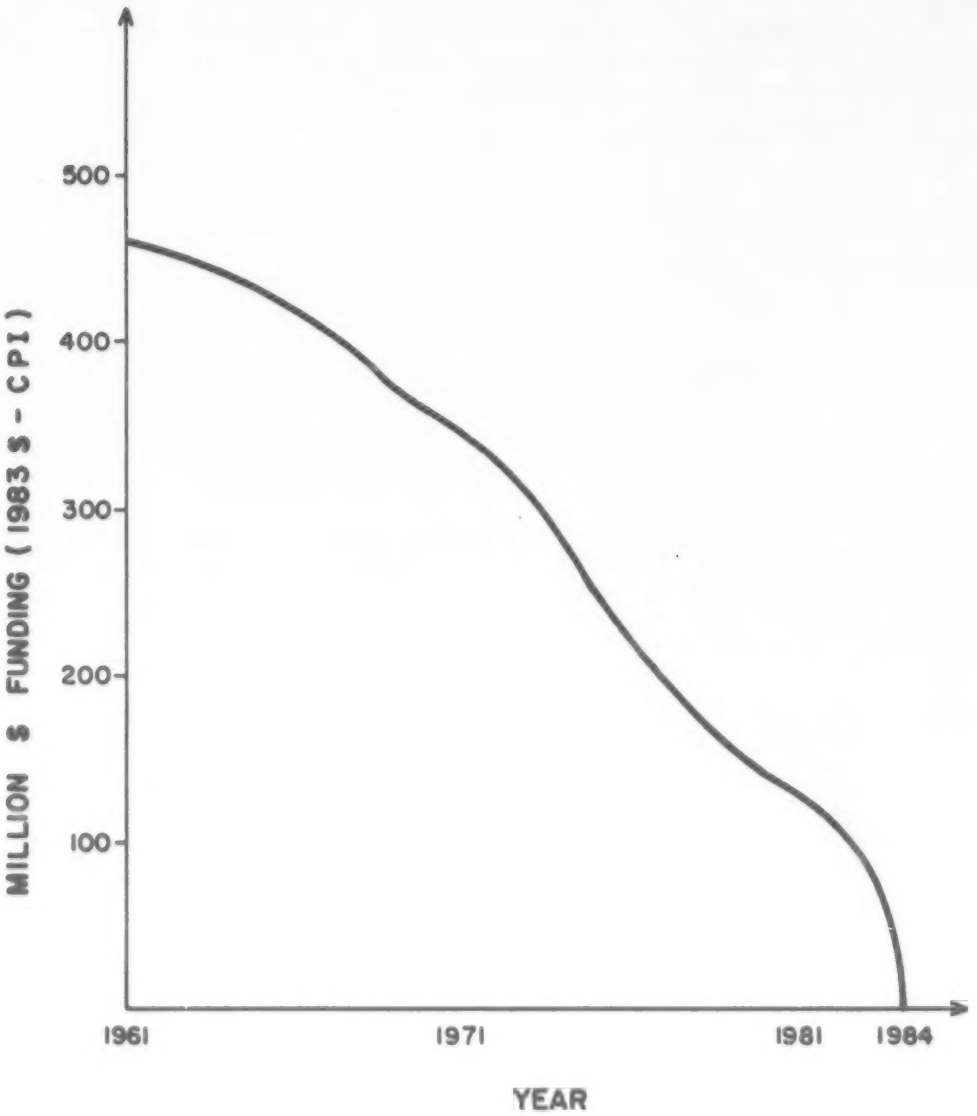
A profile on Federal Government support for municipal infrastructure in Canada is presented in Appendix E. This profile presents background information and general funding allocations for the major programs in support of municipal infrastructure including - the Municipal Infrastructure Program (1961 to 1978), the Neighbourhood Improvement Program (1974 to 1977), the Municipal Incentive Grant Program (1975 to 1978), the Community Services Contribution Program (1979 to 1980) and the UTAP Program (1978 to 1984).

Federal support for municipal infrastructure in Canada reached a peak in the mid to late 70's. The history of formal support for municipal infrastructure began in 1961 with the introduction of the Municipal Infrastructure Program that was provided under the National Housing Act. Other programs that were directly targeted to municipal infrastructure included the Neighbourhood Improvement Program (NIP), initiated in 1974 and the Municipal Incentive Grant Program, initiated in 1975. These programs were consolidated and replaced in 1979 by the Community Services Contribution Program (CSCP). Another program directly related to municipal infrastructure was the Urban Transportation Assistance Program (UTAP), instituted in 1978 to provide for grade separation and improvements in local urban transit systems.

With the termination of the CSCP program in 1980 and the last payments being made by March 31st, 1984 along with the termination of the UTAP program on March 31st, 1984, all of the direct federal assistance related to municipal infrastructure has ceased.

Figure 18 shows the federal municipal infrastructure funding averages from 1961 - 1984 in constant 1983 dollars (CPI). This graph vividly depicts the Federal Government's withdrawal of support from the municipal infrastructure area. This report does not include those federal dollars channelled to employment generation programs such as Winter Works. These programs, common to the late sixties and early seventies, directed large amounts of capital to municipal infrastructure work. Such support has been much less evident in recent years, and where it has been available the criteria for involvement have been such as to limit the capacity of municipal governments to take advantage of the programs. An inclusion of this program in Figure 18 would simply heighten the discrepancy between early support and the Federal Government's current low level of interest in the area.

Figure 18. Average Annual Levels of Federal Funding for Municipal Infrastructure in constant 1983 $ (CPI)



VII. TECHNICAL COMMITTEE DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

VII.1 Technical Committee Role

The Technical Committee for this study comprised a national representation of senior administrators and public works officials who are responsible for their urban infrastructure (see list on the inside cover of report). The Technical Committee and staff evaluated both the information from other sources and the survey results on the basis of their extensive experience in the municipal field. Their evaluation focused on:

a) survey validity and applicability of conclusions on a national basis;
b) determination of the condition of the infrastructure;
c) determination of funding shortfalls and potential funding solutions;
d) identification of causes of decline and funding shortfalls; and
e) comparison with the situation in the U.S. and Europe;

VII.2 Survey Validity

The Technical Committee felt that the survey response was excellent for cities over 400,000 population with all responding (although not in time to evaluate all their results).

The Committee felt that the survey was representative of Canadian communities over 100,000 population because of the high response rate of 64%. Thus, for this segment of the population, national projections such as the $598 per capita to upgrade are felt to be valid.

For municipalities with populations between 10-100,000, the response rate was about 17% of the population. Although the projections on a National basis seem reasonable, they are less supportable. More data would be required for National projections. Projections from the general survey questions are more supportable than from the detailed questions on the specific infrastructure facilities because respondents answered more of the generalized questions.

There was less than a 1% population response from communities in the population range of 1,000 - 10,000. These communities are essentially rural in nature and results from the survey are not representative of the situation for these small communities. The results from these small communities are presented in a separate addendum.

In summary, the 80 responses are a good sample size and the results are felt to be representative of the urban communities in Canada.

VII.3. Condition of Infrastructure

The first objective of the Municipal Infrastructure Task Force is to inventory the present condition of municipal infrastructure in Canada. The results from the survey provide two measures of the present physical condition of the Canadian municipal infrastructure:

i) an opinion by mayors and senior administrators; and
ii) actual data which quantifies the condition.

Both measures are important for appreciation of the current condition. Survey results indicate that physical infrastructure such as roads, bridges, sidewalks and sewer systems are in the poorest condition. The Technical Committee supports this conclusion.

Survey data was also obtained on trends in condition. Results show that the basic infrastructure systems of road pavements, bridges, sidewalks, sewer and water systems are deteriorating. On the basis of their experience, the Technical Committee feels this represents the trend in Canada.

The most important statistics for quantifying the condition of the infrastructure are:

i) the costs to upgrade to acceptable levels; and
ii) the number of emergency repairs or occurrences.

Objective 5 deals in part with the costs required to upgrade the infrastructure to acceptable levels. Statistics on the per capita costs to upgrade specific infrastructure systems are shown in Figure 10.

The extent to which the specific infrastructure systems have fallen into disrepair is evidenced in capital costs of $249 per capita to upgrade roads, $153 per capita for sewers, $135 per capita for waterworks and $61 per capita to upgrade bridges for a total cost of $598 per capita. This is an extensive work program and the Technical Committee feels a reasonable period to upgrade the infrastructure would be over ten years. It is noted that over this 10 year period there will be deterioration of facilities which are presently in acceptable condition and even further funding may be required for upgrading.

Statistics on emergency repairs or occurrences are shown in Figures 12, 13 and 14 for specific infrastructure systems. Roads are experiencing a dramatic increase in emergency repairs (Figure 12). Water (Figure 13) and sewer (Figure 14) systems disrepair as measured by breaks are also increasing. The Technical Committee notes that increased revenue sources for maintenance are necessary to ensure the condition of the infrastructure does not deteriorate further.

The conclusion of the Technical Committee is that there is a significant infrastructure problem in Canada. The data clearly shows that the basic physical facilities such as roads, sidewalks, bridges and sewers are in the poorest condition and are deteriorating while other facilities are in better condition. There is an increasing number of roadway emergency repairs and sewer breaks. To upgrade the infrastructure will require a substantial increase in revenues. Even when spread over a ten year period, these costs represent an increase in currrent public works budgets of about 25%. Overall, the Technical Committee feels that sufficient information is available to conclude that there is an infrastructure problem in Canada and steps should be taken to rectify the problem.

An important observation from this survey is the lack of historical data for many municipalities, especially smaller communities. Several responses had comments relating to insufficient data and also standards for measuring the condition. The lack of standards is evidenced in the variation of standards used for determining the acceptability of similar infrastructure systems.

Objective 5 also deals, in part, with projects necessary to bring the municipal infrastructure to acceptable levels. Specific projects will be determined as part of the Phase II study, if approved.

Technical strategies for municipal infrastructure renewal and maintenance have to be implemented at local levels. The main elements include an initial and ongoing inventory and condition assessment, a means of determining the best time to repair or replace, and efficient technology to get the greatest amount of rehabilitation for a given unit cost.

Pavement management systems are available to help cope with a deteriorating road system. The basic elements of this system are a careful and systematic inventory of road and pavement conditions coupled with established maintenance levels-of-service, i.e. the level or condition at which a particular maintenance activity should be completed. These levels-of-service influence work priorities and resource

allocations. Knowing when to carry out a specific type of maintenance or rehabilitation and then doing so on time is the key to maintaining good roads at low cost. Deferred maintenance does not simply put off today's maintenance costs to tomorrow but actually increases costs. For road systems it has been found that pavement conditions get worse at an increasing rate with time. Lowest annual maintenance costs occur when resurfacing is carried out when roads are at their lowest acceptable condition (i.e. before the point of incipient cracking).

The situation with regard to underground services is not as well defined because it is much more difficult to maintain up to date inventory and condition records. The design life of pipe materials may vary greatly and may be as long as 100 years. Estimating pipe condition by age alone is unrealistic. The actual life of facilities depends on many factors including original design, quality of construction, use, and maintenance as well as the surrounding environment. Analysis of past maintenance records including information on the type of facility, its geographical location, the type of failure and the type of maintenance required can give estimates of present system conditions. Also important are leak detection surveys, flow monitoring surveys, closed circuit television inspections and, in larger sewers, visual inspections.

Combining this type of information with economic analyses of rehabilitation alternatives can give a rational, least annual maintenance cost system for determining work priorities and resource allocations. Although there is still much research to do it is likely that some form of management system applicable to underground services analogous to the pavement management system can be developed. Actual repair strategies for sewer and water pipes are developing quickly. The inventory and condition assessment of underground services make possible cost-effectiveness considerations of in-place rehabilitation rather than the replacement of broken pipes based on "crisis management" alone.

As a solution to inventory management, microcomputers for about $20,000 are now available which can provide management data on a specific infrastructure system. Better management could be obtained by monitoring information on:

i) length
ii) size
iii) age
iv) service record - preventive maintenance and emergency repairs
v) labour statistics - productivity
vi) material costs by function
vii) timely budget information.

With this information, managers can design better infrastructure systems, can maintain them more cost-effectively and as a result, can better serve the public. In addition, managers can determine where the greatest needs are so that program priorities can be set.

To summarize, the Technical Committee feels that many communities (especially the smaller ones) do not keep adequate records with regard to the condition of the physical infrastructure and do not have sufficient staff devoted to this aspect of management. Better information systems and standards should be developed to better manage the infrastructure. Mauals on management practices could be produced to assist in this process.

VII.4 Funding

Local Governments

The major responsibility for funding urban infrastructure lies with the local governments. A breakdown of current revenue sources for specific infrastructure systems is shown in Figure 9. User fees provide most of the funding required for water and sewage systems (about 80%). General Tax revenues are the largest source of funding for roads (about 60%) and bridges (about 50%). Provincial funding for roads and bridges is the second largest source, providing approximately one-quarter of the funding. Survey results show that Federal funding is almost non-existent except for bridges (about 5%).

The Mayors' pre-survey indicates that funding is inadequate. The national survey supports this conclusion and shows that the degree of underfunding in such areas as roads, bridges, sewer and water facilities is significant. The survey shows that, in the period 1968 to 1983, Public Works funding, as a proportion of total municipal budgets, has declined while need is growing. On the basis of their personal experience, every member of the Technical Committee felt that the case in many municipalities was even worse than the survey indicated for the following reasons:

i) the infrastructure is aging and therefore more costly to maintain;
ii) public demands for service are increasing;
iii) public works facilities are expanding more than other facilities;
iv) Federal funding has declined (Section VI);
v) 1983 could be an abnormally low budget year because of the recession;
vi) there may have been a shift of responsibility for some social functions to the Provinces;
vii) possible ambiguities in the survey questions.

In any case, the survey showed that the costs to bring the most seriously deteriorated forms of infrastructure (sewer, water, road and bridge systems) back to acceptable levels are high ($598 per capita).

The Committee felt that this result is valid for communities with populations over 100,000 and is the best evidence that funding has not been sufficient to meet all the needs in the Public Works area. Although this figure seems reasonable for the other population groups, more data is required for validation. The majority of this cost is in roads and bridges. Even when spread over a 10 year recovery period, as suggested by the Technical Committee, these costs represent an increase in current public works budgets of about 25%, which is beyond the ability of many local governments. Therefore, some assistance from other levels of government is required. It is noted that over this 10 year period there will be deterioration of facilities which are presently in acceptable condition and even further funding may be required for upgrading.

Traditionally, funding sources have depended on the nature of the work and the type of facility. Maintenance is usually funded from each year's revenues derived directly from annual taxation. Replacement and new capital facilities such as bridges, roads, sewers and water systems are frequently funded through borrowing. The cost of large capital facilities obviously cannot be funded from the current budget, and in the same way an individual homeowner finances his house through a mortgage, a municipality usually borrows to finance such facilities.

However, even though the foregoing financing approach still predominates, the Technical Committee has found that there is a growing tendancy towards short term planning and pay-as-you-go financing. This has placed infrastructure replacement funding in direct competition with funding for other short-term needs such as Police and other social services and additional load is placed on direct taxation. In view of current extreme restraint, insufficient funding is being provided from direct taxation to meet infrastructure requirements. In fact, some senior administrators are encountering situations where the Council is trading off capital replacement projects against normal maintenance. In addition, the following additional concerns with regard to pay-as-you-go financing have been expressed:

1) it limits proper planning and scheduling of work. This occurs because pay-as-you-go expenditures are financed from that year's operating budget which can be affected by many uncertainties such as Provincial revenue sharing, wage settlements, the size of the operating budget and the amount that Councils want to raise taxes.

2) it causes non-effective use of staff. Effective use of staff depends on being able to plan work well ahead of the actual construction. This is impossible under a pay-as-you-go program which cannot be determined until well into the year in which the money should be spent. Thus, too much pay-as-you-go means panic designing and fluctuating of design workload to the point of waste.

3) it cannot absorb major fluctuations in spending which happen when large infrastructure components such as bridges need to be replaced.

4) it creates some inequity in that today's tax payers are forced to pay the total cost of infrastructure that will benefit future taxpayers up to 100 years from now.

The Technical Committee found that problems due to pay-as-you-go financing have been experienced in both the eastern and western regions of Canada.

Along with the increased attention to maintaining urban infrastructure, there also is an increasing interest in developing continuous reconstruction programs to avoid large, expensive one-time projects and their inherent financing and political difficulties. Continuous programs offer the advantages of maintaining a constant sized work force for infrastructure replacement programs and thus more uniform capital financing demands. However, up to now, Municipal, Federal and Provincial funding sources have not been consistent enough to encourage the development of many continuous replacement programs and on an overall basis, the total funding for infrastructure replacement has not been sufficient. As a result, a backlog of work is growing and the method of replacement chosen is often not the best option when evaluated on a life cycle basis. Standards are relaxed, asphalt is installed rather than concrete and the facility is replaced cheaply, but it will not last as long. As a result long term infrastructure problems continue to grow.

The Technical Committee concluded that in order to safeguard the economic health of our urban areas, local governments should re-examine methods of financing and priorities for funds so that the most essential basic services are emphasized during times of severe restraint. In addition, the Technical Committee felt that additional funding is required. However, it is difficult to solve the problem of revenue shortfall solely by increasing general tax revenue because of increased public concern with local government spending. Therefore the Technical Committee felt that additional local government funding sources should be found.

In addition to increased use of user fees and increased Federal and Provincial government funding, a number of remedies were suggested in the U.S. and Europe, some of which have more applicability there than in Canada. However, it is appropriate to review some of the alternatives to the traditional methods of financing. They include:

Leasing Schemes	-	Lease purchase and sale-leaseback agreements. Private investors provide the capital facilities then lease them to the government.
Pension Fund Market	-	historically centered on stocks and bonds of major corporations but coming under pressure from labour and government to make "socially beneficial" investments.
Public-Private Partnerships	-	the privatization or contracting out of public services.
Bond Banks	-	smaller centres pool their needs into one large debt marketed by the bond bank.
Infrastructure Development Banks	-	make favourable interest loans capitalized by bond issues, government appropriations, revenues, and private investors.
Infrastructure Bonds	-	used to enable public investment in the community by selling bonds to citizens of the community.
Municipal Enterprises	-	involvement of municipalities in profit making corporations and use of profits to offset infrastructure costs.

These and other financial alternatives are only new in the sense that they have not been used to any great extent to finance public works projects by Canadian local governments.

User Charges

It is difficult to solve the problem of revenue shortfall solely by increasing general tax revenues. Increasing concern about local government spending is leading to "taxpayer revolts" such as the Proposition 13 referendum in California. Therefore, the Technical Committee reviewed the possibility of increasing user charges as a source of funding. At the present time user fees provide most of the funding required for water systems and sewage treatment but are not used to a great extent for the other infrastructure systems. Examples of user fees which could be used more are toll roads and bridges, park entrance fees and public transit charges.

Some of the less obvious examples of user fees are the collection of gasoline taxes and motor vehicle license fees which may be used to offset the costs of construction and maintenance of the roadway system. Currently, these taxes are being paid by the consumers but, in Canada, they are not being directed at the road system which allow the funds to be generated. With appropriate rate structuring, user fees can encourage conservation and efficient use of available facilities. However, because public services are generally in a monopoly situation, a great deal of care must be taken in setting rates that are equitable. Impost fees (a connection charge) may be levied to aid in offsetting the additional stress placed on the existing infrastructure by new development. In addition, Local Improvement Procedures which provide for cost sharing with those directly benefitting are an appropriate mechanism to expand funding sources.

In summary, the Technical Committee concluded that the possibility exists for increasing user charges in the sewerage, roads and bridges areas. However there is concern with regard to equity because the direct "users" of a public works system are not its only beneficiaries. In some parts of Canada, the users will not accept higher charges than they are already paying. Cities that have tried it had some negative remarks on a total user-pay system and cited problems such as the difficulties of determining and administering an equitable collection of funds.

Federal Government Programs

Federal Government funding programs have been declining steadily over the past 15 years and as of early 1984 all of the direct Federal assistance related to municipal infrastructure has ceased.

The Technical Committee generally concluded that the required funding for infrastructure replacement is beyond the ability of many local governments and that some assistance should be sought from Provincial and Federal Governments. This is especially necessary for works that have regional or provincial benefits and implications. Concern was expressed, however that the funding provided in the past for projects with only municipal significance has had too many restrictions as to the type of use. This has the tendency of distorting the project priorities and often the most pressing matters are not dealt with first. They also tended to make work under these programs less efficient and more expensive. If Federal programs were to be created to deal with the infrastructure problem at this time, regulations should be altered to make them more effective.

There has also been a tendency to emphasize new construction because Federal programs have largely been geared towards reducing unemployment. Additional employment has been equated to new works rather than maintenance and reconstruction works - presumably because maintenance of existing infrastructure is an ongoing function and new jobs would not result. With significant layoffs of local government staff in various parts of Canada, this is no longer the case and Federal funding for maintenance and replacement works could create additional jobs. In addition, Canada has been an expanding nation and therefore national priorities have emphasized expansion as opposed to replacement. However most of the growth is now taking place in urban areas which are serviced by existing infrastructure systems and it is here that the greatest problems are developing. Therefore, the Committee felt that national priorities may need adjustment and that any new Federal programs which might be developed should place a greater emphasis on maintenance and reconstruction as opposed to new construction.

Future programs could either be in grant form, part grant form, low cost loans or in the form of giving access to additional revenue sources. Possible examples include surcharges on the gas tax, sales tax, hotel tax and motor vehicle licence fees.

The Committee also felt that it was very important to minimize jurisdictional barriers that currently exist between Federal, Provincial and local Governments.

In recent years, the Federal programs have been significantly reduced to the point where Federal assistance for infrastructure work is now very limited. Even though Federal contributions were never very large in relation to local government contributions towards infrastructure work, the reduction of Federal programs, when added to the inadequacy of local government funding, has resulted in a worsening of the revenue shortfall situation. In the U.S.A., remedial measures currently being implemented involve Federal government participation. Significant steps in this direction have already been taken and others are in preparation. The Technical Committee has found that similar steps are required in Canada to assist local government in solving the infrastructure problem. The Committee recognizes that intergovernmental relations in Canada between the Federal, Provincial and Local Government levels are different and this will have to be recognized in setting cooperative programs between the three levels of government for the purpose of dealing with revenue shortfall.

VII.5 Causes of Decline

At the present time there are many impediments to successful rebuilding and protection of infrastructure systems. The survey listed five of the major ones and the results were shown in Table 6.2 and Figure 11.

Based on these results and their own experiences the Technical Committee concluded that these impediments can be ranked in the following order: funding shortage, prolonged public involvement, red tape, political inaction and lack of staff. The Technical Committee further concluded that methods should be investigated which would reduce waste and excess costs caused by these impediments. Further discussion on each of these impediments is given below.

VII.5.1 Funding Shortage

As expected funding shortage was identified as the leading cause by over 90% of respondents. Revenue shortfalls of $598 per capita are projected for large municipalities. The previous section on funding shortfalls detailed many of the causes for this shortage.

VII.5.2 Prolonged Public Involvement

The Technical Committee found that prolonged public involvement is the second most frequent impediment after funding shortage. There have been numerous examples of worthwhile projects being cancelled or held up for unreasonable lengths of time by prolonged involvement from the minority who might be adversely affected by the project. Often it is the same negative issues that are brought up time and time again.

The Technical Committee recognized that growing environmental and increasing local area concerns must be accommodated. However, it must be recognized that there is a cost involved in the delays created. Some suggestions for improvement in this regard are that public involvement be incorporated early in the process, and that officials become more skilled in dealing with these impediments.

VII.5.3 Red Tape

The Technical Committee identified several Federal programs as examples of red tape and delay. The large number of restrictions and conditions which had to be met - largely for employment creating reasons - have tended to make work under these programs less efficient and more expensive. If Federal programs were to be created to deal with the infrastructure problem at this time, regulations should be altered to make them more effective.

Federal programs are not the only example of red tape problems. Provincial and even local governments create delays with their regulations - some of which are unnecessary and could be eliminated. In some Canadian cities there is already an effort to reduce red tape and this should be expanded.

VII.5.4 Political Inaction

As mentioned in the prolonged public involvement section, local councils tend to be very responsive to the Public. However, Councils often attempt to hear all the concerns of all interested parties and this tends to delay necessary decisions. Public input is important but procedures should be established to ensure the input is early in the process and is not overly repetitive.

In addition, in this time of recession, local Councils are becoming very concerned about the budget and its effect on annual taxes. More in depth evaluations are being performed to ensure the best expenditure of taxpayers monies. However, this process often delays critical work and the individual projects cost more in the long run.

VII 5.5 Lack of Staff

Although lack of staff for problem analysis was identified as the least significant cause, the Technical Committee concluded from the survey response that it was a significant problem, particularly in smaller municipalities. It was apparent that the lower survey response from the smaller municipalities was due to inadequate information retrieval systems and inability to analyze available information. The Committee concluded that improved management systems would be one objective which could assist in coping with the infrastructure problem. To this end, the Committee concluded that increased interaction of officials in Canada was desirable - perhaps through strengthened national associations.

VII.6 Comparison with the U.S. and Europe

This study has shown that Canadian urban areas are faced with the same problems identified in U.S. studies. The revenue shortfall at the local government level is perhaps somewhat less than in the U.S.A. but, on the other hand, the decrease in Federal assistance is more severe. Studies in both the U.S.A. and Canada have identified roads as having the greatest need of attention. There are similarities for most other types of infrastructure. The U.S. has recognized the problem sooner and are already beginning to deal with it. There is considerably greater public awareness of the problem in the U.S. and legislation to increase funding for infrastructure work has already been passed or is in the process. Some of the solutions being implemented in the U.S., such as senior government funding programs to assist municipalities in difficulty, would be applicable in Canada. In both countries, it is clear that local governments need additional revenue sources and assistance in order to cope with the backlog of work and prevent further deterioration of the infrastructure.

The Technical Committee felt that public awareness of the problem in Canada should be increased and that the Phase I report get wide dissemination in order to obtain public support for necessary remedial measures.

The Technical Committee was represented at the seminar on urban infrastructure in various European cities which was sponsored by the FCM and the APWA. A general finding is that most existing facilities in European cities are in better condition than in Canada, and officials report less backlog of work.

There is more involvement of Central or Federal Government in local maintenance funding than in Canada. Various grant and assistance programs exist. There is also less autonomy of local government in local decision making and priority setting.

European local governments are involved in more services than in Canada. An example is housing in England. In an effort to reduce government burden, there is a trend to privatization of such services in some European countries.

Some European cities are involved in enterprises such as banking, mining, etc. These provide profits which can be used to offset costs of some services provided by local government. These constitute funding sources not available in Canada.

European central governments are now exerting pressure on local governments to hold down rates and taxes in order to control inflation. This is now resulting in the growth of maintenance backlogs. However, this trend is more recent than in North America and less backlog has developed so far. Local government officials indicated that they expect problems to grow now.

Except for one in England, there were no comprehensive national studies of infrastructure available in Europe. Information retrieval systems for infrastructure are not as advanced as in North America. On the other hand, work is in progress on setting of service standards. The Technical Committee has concluded that Canada should be part of this effort and work in concert with the U.S.A. and European countries. This, however, is a very complex task which will take many years. The Technical Committee debated setting of standards and concluded that reconstruction of our infrastructure should not await completion of the standards process.

In summary, the Technical Committee concludes that the condition of Canadian infrastructure is better than the U.S. but not as good as in European cities. Similarly, local government revenue shortfall is probably between that of the U.S. and European cities. With regard to central government funding, Canadian cities receive less than their U.S. counterparts and very considerably less than European cities. The Technical Committee concludes that central government funding towards rebuilding of Canadian urban infrastructure must be increased.

VII.7 Phase II Study

Phase I of this study is a preliminary work which forms the foundation necessary for completion of the study. It provides an assessment of the condition of urban infrastructure, of funding adequacy, of problem areas, their causes and possible solutions in general terms.

From the outset, it was realised that, in view of the extremely short time available, a second phase would be necessary. The major purposes of this second phase are:

1) To refine the data received in this survey. Certain questions were inadequately answered to draw firm conclusions and certain parts of the sample need to be augmented to improve validity in critical areas.

2) To crystallize FCM policies. Phase I has outlined generalized policies which would provide guidance and direction towards recovery. Specific policies should now be outlined that could be approved by the FCM and disseminated to its members.

3) To outline corrective programs. The process of developing actual programs to implement the general policies outlined above should begin. This can include further work on improved management systems, on innovative financing methods, and on increasing public awareness of the problem.

4) To seek assistance from other levels of government where appropriate. Some assistance will be required from the Provincial and Federal governments. Phase II should explore and outline means through which all levels of government can cooperatively approach the problem of reconstructing our deteriorated infrastructure. This effort should begin at the political level and be followed up at the technical level by a review of possible works programs which could not only reconstruct the infrastructure but, at the same time, deal with unemployment and contribute to Canada's economic recovery.

As with Phase I, there will be certain direct costs for processing of data, report preparation and travel. These costs are estimated to be about $50,000 which should be raised prior to the study beginning. Significant additional contributions of municipalities and officials will, of course, be required and it is hoped will be borne by them individually as was the case in Phase I.

The Technical Committee debated the necessity of Phase II of the study at this time. There was some division of opinion but, finally, it was decided a Phase II study should proceed as outlined above with care being taken that refining of the survey results be limited. The Committee also felt examination of the social infrastructure areas could not be comprehensive. In later discussions with the Task Force Chairman, Mayor Harcourt, he decided that Phase II should concentrate on establishing a cooperative effort towards program implementation at the other levels of government. He decided that further work on social infrastructure should be undertaken by the separate Task Force on Social Services. He also decided not to pursue refining the poor survey results from municipalities under 10,000 population but, instead, to suggest a separate Task Force be set up for this purpose at a later time. The Phase II outline above reflects these decisions.

VII.8 Conclusions and Recommendations

On the basis of previous studies, comparisions with the US and European countries, its own experience, and the survey results outlined in this report, the Technical Committee on Canadian Urban Infrastructure has reached the following conclusions and makes the following recommendations:

1) A significant decline has occurred in the condition of infrastructure in Canadian urban areas. Steps should be taken to halt that trend.

2) The costs to bring the most seriously deteriorated forms of infrastructure (sewer, water, road and bridge systems) back to acceptable levels are high. Even when spread over a 10 year recovery period, these costs will represent an increase in current public works budgets of about 25%.

3) Additional local government funding sources should be found to solve the revenue shortfall problem identified.

4) To raise the required funding is beyond the ability of many local governments and some assistance from other levels of government is required.

5) Better information systems should be developed, particularly in smaller municipalities, to permit better management of infrastructure systems and more effective use of available funding. Lack of information was a frequent reason given for not completing the survey questionnaire.

6) Greater interchange of information between Canadian municipal officials should be achieved through strengthened national associations and the publication of manuals on management practices.

7) To achieve a greater degree of national consistency in levels of infrastructure service, work should begin on the setting of service standards. This should be done in concert with the U.S.A. and European countries who are currently working on these. This is a long term effort and rebuilding of infrastructure should not await its completion.

8) Methods should be investigated which would reduce waste and excess costs due to delays and other impediments to reconstruction and maintenance of infrastructure.

9) Without jeopardizing the provision of new facilities needed to meet growth, a greater emphasis should be placed on maintenance and reconstruction as opposed to new construction, especially in Federal programs which might be developed in the future. This would extend the life of existing facilities.

10) Local governments should re-examine priorities so that the most essential basic services are emphasized during times of severe restraint. If this is not done, the economic health of our urban areas may be jeopardized and, with it, the other services as well.

11) Policies should be set by the FCM which could form the foundation and guidelines for rebuilding of infrastructure. The FCM should direct its Task Force on Urban Infrastructure, through its Technical Committee, to outline specific policies.

12) Programs should be established to begin implementing these policies and to deal with the reconstruction of the deteriorated forms of infrastructure over the next 10 year period.

13) An intergovernmental partnership should be established which would bring the combined and cooperative efforts of the three levels of government to the solution of the infrastructure problem. The opportunity exists to reconstruct our urban infrastructure, to make our urban areas more competitive, to strengthen Canada's economic recovery and, at the same time, to employ large numbers of Canadians in these labour intensive works.

14) National priorities may need adjustment to recognize that Canada is becoming an increasingly urbanized nation. It is in our urban areas that most Canadians live and it is here that our greatest problems are developing.

15) Public awareness of the infrastructure problem should be increased to obtain public support for necessary remedial measures through the wide dissemination of this report and other means available to the FCM.

16) The FCM should direct its Task Force, through its Technical Committee, to proceed with Phase II of this study in order to crystallize policies and outline programs necessary for corrective action in cooperation with other levels of government where necessary.

17) Estimated costs of Phase II are $50,000. Funding should be provided for this purpose.

VIII. ACKNOWLEDGEMENTS

To produce this report in the extremely short time available required the cooperation and contributions of many. The following deserve particular recognition.

A direct cost was incurred in preparing survey questionnaires, analysing survey results and preparing the associated text and graphics. This cost, of about $45,000, was raised on an interim basis by the following FCM Big Cities Conference members: Halifax, Quebec, Ottawa, Hamilton, Winnipeg, Regina and Vancouver. In addition, the Province of Nova Scotia and the Canadian Construction Association also contributed. Without these contributions, the study would not have been possible.

The cities that provided members and assisting staff to the Technical Committee, which are listed on the inside front cover, made significant contributions in terms of staff time as well as the necessary travel expenses that Technical Committee members incurred in attending our national meetings. The very considerable effort of FCM staff and of staff from the University of Toronto and the University of New Brunswick are also acknowledged and appreciated. Although this report is a cooperative effort of all persons identified on the inside cover, certain portions of the report were the prime responsibilities of individuals. The preparation of the survey, its analysis and the graphics of the main report as well as the literature review were the responsibility of Professors G.W. Heinke, B.J. Adams, E.J. Bowering and M.C. Ircha of the Universities of Toronto and New Brunswick. The analysis of Federal funding trends and of the Mayor's pre-survey were carried out by Jim Knight, Executive Director of the FCM, with the assistance of his staff. City of Vancouver Staff contributed to the Mayor's survey, the national survey, the analysis, graphics and other portions of report preparation.

The experience of the senior officials representing the municipalities involved in the Technical Committee was crucial to the evaluation of the information which was gathered and, particularly, to the conclusions that were reached. The time which was devoted by these officials during the very busy budget period of most municipalities is very much appreciated.

Finally, the Mayors and municipal officials who took the time and expended the considerable effort necessary to complete the survey questionnaires provided the necessary information which forms the foundation of the study. This contribution was invaluable.

APPENDIX A

LITERATURE REVIEW OF MUNICIPAL INFRASTRUCTURE

by

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University of Toronto

APPENDIX A

LITERATURE REVIEW

A-1 Raising the Issue

During the past two decades interest in maintaining the natural environment has emerged in society. Following almost a century of neglect, public consciousness has become increasingly aware of the problems of natural resource depletion and pollution of the environment.

Recently, another heritage seems to have been discovered which has long been taken for granted - the inheritance of public works facilities and infrastructure. Much of this infrastructure, installed during the past century, provides an essential foundation for the economic and social activities occurring in urban centres. Because this infrastructure is often hidden from view (buried underground), it is largely ignored by the public. It is not until failure occurs and these services are no longer provided that the importance of proper care and maintenance of our public infrastructure is realized.

At 17.16 on November 9, 1965, the power went out in New York City (52)*. The ensuing chaos was a dramatic example of the degree of dependence placed on public works facilities. The media is full of news of watermain breaks, sewer collapses, hazardous leakages from sanitary landfills and other waste disposal sites, bridge collapses, overcrowded highways, airports, urban transit systems, and most significantly, indications of major cities being on the brink of bankruptcy. Are these isolated incidents or are they symptoms of a more serious epidemic plaguing our public works system?

Choate and Walter in their book America in Ruins: Beyond the Public Works Porkbarrel (1) state that America's infrastructure and public facilities are deteriorating and are wearing out faster than they are being replaced. For Americans, to continue the current trends will mean a decline in their quality of life and, more importantly, a decline in their economic

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* see References at the end of the text.

capabilities. A study by a group of labour and business leaders in the U.S. (4), considered the "needs studies" prepared by federal agencies for facilities which receive federal funding. For bridges, roads, and urban water supply and wastewater treatment, apparent needs over the period 1983-1995 are $38 billion per year. Of this $17 billion is required for new expansion and $21 billion for reconstruction and replacement of existing facilities. Comparing the expected needs with current or planned spending indicates a funding shortfall of $9 to $11 billion per year.

Recently, conferences have been held in the U.S. and Europe on the topic of infrastructure renewal. Concerns for revenue shortfall and the difficulties of rehabilitating existing infrastructure have been addressed by representatives of federal and local governments, engineering consultants and the construction industry.

Is this issue of infrastructure decay relevant in Canada? Are Canadian public works facilities wearing out faster than they are being replaced? The little we heard in newspapers and magazines on this issue is usually with regard to problems encountered in the U.S.. Symptoms of decay and inadequacy such as a worn out, 100 year old water supply system in Yarmouth, N.S., or major rehabilitation needs for Toronto's elevated Gardiner Expressway, and the blockage of rail traffic due to landslides in B.C. are generally treated as separate, unrelated incidents. Public pronouncements of increased spending on public works typically cite job creation as their rationale rather than the problems of infrastructure decay (50, 51, 53).

The conditions blamed for infrastructure decay in the U.S., - deferred maintenance due to budget cutbacks, high interest rates and inflation, - appear to be similar in Canada and indeed in many areas of the world (5). Municipal administrators are usually aware of the problems fostered by budget cutbacks and deferred maintenance of existing infrastructure. As pointed out in the U.S., a number of cities have made "spectacular reductions in their capital spending"; however, such saving today may mean greater replacement costs tomorrow (47). As in the U.S., the issue of infrastructure decay in Canadian communities must be examined nationally. Problems arising from deferred maintenance practices must be identified

and brought to the attention of elected officials and the general public. In this way, necessary long term investments in our public works infrastructure may be forthcoming.

A-2 What is meant by Infrastructure?

Infrastructure can be defined as the underlying framework of a system. The political, economic and social activities in society are based upon a social and a physical infrastructure. Social infrastructure includes the structure of government, the our legal, educational and cultural systems as well as many social services. The physical infrastructure consists of man-made facilities such as transportation and communication facilities, power generating stations, water supply and distributions systems, and sewage collection and treatment facilities.

Among civil engineers, the word infrastructure is used mainly with respect to the physical plant or public works facilities. These are facilities provided by one or more levels of government as opposed to those facilities (such as power or communications) provided by utilities or private companies. The bulk of this infrastructure is concentrated in urban areas and is normally the responsibility of the local government to build and maintain. The categories of infrastructure common to most municipalities are: streets, roads and bridges, water supply and distribution systems and wastewater/stormwater collection and treatment systems. The operation and maintenance of these facilities often accounts for a large portion of annual operating budgets. Other important public facilities such as parks, recreation facilities, transit systems, public buildings, hospitals and schools are considered as part of a broader definition of the term infrastructure.

These basic public services provided in a community are necessary to support public health, safety, and economic development. A survey of 809 cities in the U.S. (40) indicated that their major concerns for upgrading or repairing facilities was the protection of public health and the provision of residential services. The next most important reason was economic development. All other reasons, including federal and state requirements were considered to be far less important.

A community without adequate public facilities may not be able to attract new development. The U.S. Bureau of Census surveyed over 2000 firms in 254 categories of products (43). For most firms the availability of public works facilities was of critical or significant importance to their location decisions. To quote Choate and Walters ".... while public works in themselves are never a sufficient condition for economic development, they are almost always a necessary condition" (1:17).

A-3 How bad is the Problem?

With the issue of deteriorating infrastructure raised to greater public attention, it is then necessary to determine how bad the situation is. Are incidents of watermain breaks, bridge collapses and deteriorating highways occasional incidents or are they warnings of an upcoming epidemic of collapse of services? Is the present situation acceptable? Are conditions actually deteriorating or are they improving? How do conditions differ in North America, Europe and elsewhere? Unfortunately, these questions are difficult to answer due to the absence of relevant information.

United States

Choate and Walter, in their book America in Ruins (1), discovered that a quantitative estimate of infrastructure deterioration could not be made due to a lack of information of inventory, current condition, and relevant cost estimates for repairs and replacement. Their analysis and similarly that of Labour-Management Group's study (4) were mainly based on documents produced by U.S. federal government agencies.

There have been some recent efforts to bridge this information gap. The American Public Works Association (APWA) surveyed a number of cities in both the U.S. and Canada (5). A joint survey was conducted by the National League of Cities and the United States Conference of Mayors (USCM) (40). Both of these surveys were concerned primarily with city or municipal infrastructure needs and expenditures. There is presently a major effort underway to inventory public works facilities on a state-wide basis. Some of the U.S. states have completed the survey while others will

complete it during 1984. It is sponsored by the Joint Economic Committee of the U.S. Congress and is being coordinated through Dean Marshall Kaplan, Department of Public Affairs, University of Colorado.

The major findings of these U.S. surveys show that there is indeed a general deterioration of the municipal infrastructure and a backlog of needed repairs. However, although the initial gross estimates of needed expenditures to upgrade municipal infrastructure were very high, more detailed surveys have shown that significant progress could be achieved on priority items with only a moderate increase in expenditures.

A summary of the findings of four of these more detailed surveys (1; 4; 5; 40) follows. This summary is divided into various infrastructure categories.

Roads and Highways

In the U.S. there are approximately 3.3 million miles of rural roads and highways and 624,000 miles of urban streets and roads. The federal government is responsible for only 20% of the highways but these carry over 80% of the traffic.

The U.S. Department of Transport conducts an annual assessment of pavement conditions on all U.S. highways (Table A-1). Over the years 1970 to 1978 the percentage of roads in poor conditions has remained approximately the same. However, there has been a steady decrease of roads in good condition leading to an increase of roads in fair condition. Considering that roads are traditionally not rehabilitated until they reach the poor condition, this trend indicates that in the near future the large proportion of roads now in fair condition will continue to deteriorate and require major repairs or reconstruction.

Within the 42,000 mile interstate highway system, 2000 miles need to be reconstructed annually if a 20 year life is assumed. Choate and Walters state that presently there is a backlog of 8000 miles needing resurfacing and that one in five bridges needs reconstruction or rehabilitation (1).

The USCM surveyed 809 municipalities and found that only 25% of respondents thought that their roads were in good condition. Seventy-five percent said that their roads needed major repair, rehabilitation or

replacement. In most of these cities, reconstruction/repair of roads and streets was given top priority in their capital budget.

Table A-1

Comparison of Non-Interstate Pavement Conditions (49)

	Percent of Highway Miles		
RURAL HIGHWAYS	**1970**	**1975**	**1978**
Arterials (Excluding Interstates)			
Good	48%	47%	42%
Fair	44	46	52
Poor	8	7	6
Collectors			
Good	33	30	25
Fair	58	60	66
Poor	9	10	9
URBAN HIGHWAYS			
Arterials (Excluding Interstates)			
Good	53	48	41
Fair	41	46	53
Poor	6	6	6
Collectors			
Good	43	36	34
Fair	48	55	58
Poor	9	9	8

Source: The Status of the Nation's Highways: Conditions and Performance, Federal Highway Administration, January 1981, pp. 74-75.

Estimates of expenditure needs vary widely. The LMG study (40) quoted figures from a Department of Transport "needs study" for federal roads. Over the period 1980-95, to maintain 1978 conditions and meet current standards, will require approximately $25 billion per year including bridge repairs. Current revenues for all highway systems average about

$19.5 billion per year. About 25% of this revenue is from local sources leaving about $15 billion per year for federal roads. This indicates a revenue shortfall of approximately $10 billion per year.

In 1983, the U.S. Congress passed a tax bill approving an increase in gasoline taxes specifically for the purpose of highway reconstruction and repair. This revenue is expected to reduce the shortfall to about $5 billion per year.

An important consideration in the municipal situation is the finding of the USCM survey that 62% of respondents indicated that they required aid to finance their street and road improvements. Considering the priority of this item in municipal systems indicates a serious need for federal and state financial aid.

Water Treatment and Distribution

In the area of municipal water supply and distribution, there does not seem to be the same crisis situation as in roads and highways. However, there is evidence that some municipal systems are deteriorating and that revenue shortfalls do exist, indicating that some water systems will continue to deteriorate.

In the U.S. there are approximately 64,000 community water supplies serving a population of 200 million. About 18% of these use surface water sources and serve 50% of the total population. Systems serving 100,000 people or more make up less than one-half of one percent of the total number but serve close to 50% of the population. According to an American Water Works Association survey in 1981, there was a national average of 140 people/km of watermain (25). In cities, however, the average may be five times greater. The APWA survey showed that water supply and distribution is the responsibility of about 50% of the local governments surveyed. In many cases, special boards or district authorities provide this service.

The USCM survey found the condition of water supply and storage facilities to be good in 75% of the cities that provided water. The distribution systems were also generally in good condition but not as consistently good as the supply and storage systems. Northeastern cities reported their systems as "good" far less often than other regions. Cities

with populations greater than 500,000 reported "good" only about one-half as often as smaller cities.

The condition of a water distribution system is very difficult to ascertain because it is underground. A simple method used to estimate current condition is to assume that all pipes greater than about 90 years old need replacing. This procedure was used by the President's Water Quality Task Force to determine water system needs over the period 1980-2000. These estimated costs of meeting these needs are presented in Table A-2. They do not include operation and maintenance costs.

Table A-2

An Estimate of Water System Expenditure Needs in the United States (40:59)

Needs 1980-2000	$ billion (1979)
Replace, Rehabilitation	50 - 80
Service Growth	5 - 8
New Source Development	20 - 25
Quality Improvements	0.4
Total	75.4-113.4

Over the years 1976-81, water supply investment in the U.S. averaged about $3.3 billion per year. This will have to be increased by 18-23 percent according to the LMG study to meet estimated needs. However, the situation in some cities is so bad that even if revenues are doubled it is expected that 20% of urban systems would still experience revenue shortfalls.

The source of revenue for water systems is almost entirely from user charges. Revenue shortfalls have to be made up by user fee increases. Fees are generally regulated by local political bodies and there is often strong resistance to higher fees for water use.

Estimating future needs for replacement and rehabilitation based on age alone is not realistic (17). Many water pipes installed 100 years ago are still working well, showing only minimal signs of wear. Another method for determining system condition is an examination of watermain break histories. In the City of New York, watermain breaks have been increasing at an average rate of 1.7% per year. However, individual break rates vary significantly with location, pipe size and date of installation. Maintaining a record of this information enables individual cities to make more realistic estimates of future needs. Such analysis, however, takes time and effort and is not now available nationwide.

Sewers and Wastewater Treatment

The provision of sewage collection by U.S. local governments began in the mid 1800s. By 1860, 17% of the urban population was served by sewers. By 1900, this increased to 81% of the urban population. Sewage treatment, however, lagged far behind. By 1930 only 27% of the population lived in communities which treated their wastes. Over the past 25 years, the U.S. federal government has become increasingly involved in the provision of municipal waste treatment. By 1980, 71% of the total population was served by collection systems and of these, 99% received some form of waste treatment in one of 18,000 municipal wastewater treatment plants. Metcalf and Eddy (18) report a national average of 220 persons/km of sewer pipe (not including storm sewers). Approximately, 28% of the nation's sewers are combined sanitary and storm sewers and most of these are in the older, large cities.

Of those municipalities surveyed by USCM (40), 50% said their collection systems needed major repair, rehabilitation or replacement. Of the 77% of local governments that had sewage treatment plants in their jurisdictions, almost half claimed that they needed major repairs, rehabilitation or replacement. On the whole, the surveyed communities placed storm sewers, sanitary sewers, and waste treatment as the second, third and fourth priorities after streets and roads in their capital budgets.

The needs for sewerage and waste treatment includes system expansion and upgrading as well as reconstruction of older facilities. The

U.S. Environmental Protection Agency (EPA) conducts needs studies every two years for federal funding purposes. These represent capital needs only, as federal grants are not available for operation and maintenance. The following table presents the backlog needs and the year 2000 needs in 1982 dollars (billions). The difference between the backlog and year 2000 needs represents the new construction needed for growth and expansion.

Table A-3

An Estimate of Wastewater System Expenditure Needs in the United States (40:84)

	Backlog Needs	Year 2000 Needs	% Difference
Treatment Plants	23.9	36.9	+ 54%
Repairs to existing system	7.3	7.3	0
New Sewers	25.7	38.5	+ 50%
Combined Sewer Overflows	35.7	35.7	0
Total ($ billion - 1982)	92.6	118.4	+ 28%

Expenditures on sewerage and waste treatment facilities have increased significantly in the past two decades. Average annual state and local spending in 1981 dollars (including federal grants) increased from $2.8 billion in 1960-65 to $6.3 billion in 1976-81. Sewer system expenditures averaged 5.4% of state and local government investment in the early 60s, 6.6% in the early 70s and 9.7% in the late seventies. These increases occurred largely due to the greater amounts of federal grant money available. The main priority of this capital investment was the construction of new treatment facilities. The distribution of $3.3 billion in grants for 1981 are shown in the following table:

Table A-4

Percent Distribution of Federal Grants for Wastewater Systems, 1981 (40:79)

Treatment Plants	61.6%
Repair to existing system	4.7%
New Sewers	28.7%
Combined Sewer Overflows	5.0%

Revenues for sewer system operations and expansion over the period from 1977-81 came from federal funds (41%), user fees (39%) and state and local general revenue and borrowing (20%). Expenditures over the same period were 63% for capital and 37% for operation and maintenance. These data show that user fees just manage to cover operating expenses.

Of the cities surveyed by USCM, only 25% were able to finance their collection system from their own budget and almost none were able to finance treatment system needs. Forty-two per cent said over half of their treatment system needs would have to be met by state and federal aid. Federal and local funding is now at approximately $3.9 billion per year. To meet the year 2000 needs, funding is required at $6.6 billion per year. To erase the backlog of needs by 1990, funding is required at $11.6 billion per year. This leaves revenue shortfalls of $2.7 billion per year until 2000 or $7.7 billion per year if the goal is to erase the backlog of needs in this decade.

Revenue Shortfall

Revenue shortfall is usually placed high on the list of problems leading to infrastructure deterioration. The solution therefore appears to be to increase revenues and expenditures and also to improve maintenance and repair technology. In the U.S. it is clear that investment in public works, measured in constant dollars, has been decreasing. Table A-5 shows that in both absolute and relative terms, national investment in public works has been falling.

Table A-5

National Public Works Investments (constant 1981 dollars) (1:8)

	$ Billion	$/Capita	% of GNP
1965	38.6	198	4.1%
1977	31.0	140	2.3
% Change	-21 %	-29%	-44 %

Within the municipalities surveyed by APWA, it was found that public works budgets were declining as a proportion of total budgets. Total budgets for municipalities measured in constant dollars also declined over the same period. Increases in municipa. expenditures over the last decade have been greater than increases in revenues.

Taken together, the evidence of declining total budgets and the declining portion alloted to public works shows that public works facilities are losing the competition for scarce revenues in today's retrenched municipal economies in the U.S.

Europe and Britain

Europe and Britain have, in general, much older cities than North America and the problems of infrastructure decay are familiar to them. However, facilities such as water supply and sewage systems are actually not much older there than in North America. Europeans have also realized, during the last decade that they have been taking their physical infrastructure for granted. This is no longer the case due, in part, to a number of well- publicized sewer collapses in Britain and Europe.

In England, in 1977, the National Water Council published a report entitled Sewer and Water Mains, A National Assessment (19). This inventory of sewer and water mains has proved to be a source of data for many papers written on the problems of infrastructure deterioration.

In Britain, for a serviced population of 55,625,000 (94% of the total population) there was a total length of 234,000 km of combined and sanitary sewers giving a use density of 241 persons/km of length. For water systems, the served population is 55,616,000 over a total length of 317,800 km of water main for an average use density of 175 persons/km.

In North America, system condition is often measured in terms of how much infiltration, inflow or leakage is occurring. In Britain, there is a greater emphasis on structural condition indicators such as the number of breaks per year and the analysis of visual surveys. Thus, system condition is related to structural deficiencies to a greater extent than in North America. They experience about 25 watermain breaks/year/100 km, which is similar to reported figures in North America (11). In Denmark and England, analysts have found it worthwhile to do visual inspections of sewer pipes using closed circuit T.V. and to use statistical sampling techniques to arrive at estimates of structural conditions for whole watershed areas (26, 27). The National Water Council in Britain has published a Manual of Sewer Condition Classification (14) which classifies defects in both structural and service conditions. This detailed standardized approach makes the assessment of conditions of large areas possible by statistical sampling techniques.

Further information on the most recent situation in Europe will be provided from an upcoming seminar on infrastructure. (to be added by Bill Curtis in early May).

Canada

There has been no comprehensive analysis of the present condition of the infrastructure in Canada at the national level; nor has there been an attempt to determine infrastructure condition. However, the problems of declining budgets, tight money markets and restraints on government spending are the same in Canada as in the U.S. Whether or not this has led to deferred maintenance and a deterioration of infrastructure condition cannot be stated categorically, however, indications are that similar infrastructure problems may be occuring in Canada.

The deterioration of public works facilities such as roads, bridges, water and sewer systems has not received very much attention from the Canadian news media. Most of the concern in this matter comes from the U.S. This may be because Canadian cities are in relatively better condition than those in the U.S. However, since this report was initiated by the mayors, public works commissioners and chief engineers of major Canadian cities, it shows that there is indeed concern in Canada about the current condition of municipal infrastructure.

Water Supply and Distribution

In 1981 there were 1755 Canadian communities with water treatment plants serving a population of 17,244,598 or about 82% of the surveyed population. There were 2474 communities with water distribution systems serving 20,275,786 or about 97% of the surveyed population (46). It is unknown what the total length of water distribution main is, however, work done for Ontario suggests an average density of 200 persons per km of watermain (45). If this density can be applied nationally, it indicates approximately 100,000 km of watermain in Canada.

The condition of Canadian water systems is not well known. The major cities in the central and eastern regions probably have watermains in their systems in excess of 100 years old, however, considering the post-war construction boom, an average age of about 40 years is likely for these regions. In the west, average ages are probably less.

A study carried out for the Ontario Ministry of the Environment (45) suggested that rehabilitation costs of approximately $25 per capita per year would be needed to maintain water systems at an acceptable level. Using an estimated average density of 200 persons per km of watermain, then $500 million per year is required to rehabilitate our water distribution systems. It is estimated that municipalities are currently spending only from $6 to 9 per capita on maintenance. This implies a revenue shortfall of up to $300 million per year.

Sewage and Wastewater Treatment

Of 3212 Canadian communities surveyed in 1981, 2102 communities were served by sewer systems representing a population of 17,872,705. This represented 85% of the surveyed population. Of these only 65% are on a system that discharges to some form of sewage treatment plant.

As with the water supply systems, the condition of sewer systems in general is not known. The situation is more complicated than for the water system because of the presence of combined storm and sanitary sewers. The majority of the population is served by relatively new separate sanitary sewer systems. However, the larger older systems are generally combined. In Toronto, wherever combined sewers are too small, it is common practice to build parallel storm sewers.

The national survey of sewer and water systems estimates that infiltration and inflow (I/I) accounts for about 9% of total flows in sanitary sewers. This does not indicate an alarming state of neglect nationally, but all extraneous inflow is costly to transport and treat and should be minimized. The Ontario survey estimates that sewers in the province average 30 years of age and should achieve a minimum life of 100 years. A program of repairs and renovation at a cost of about $15 per capita per year is required to maintain the system. This is approximately three times the current spending levels.

Roads and Streets

Pavement management systems have been initiated in a number of Canadian municipalities. In some provinces standardized approaches to inventorying pavement condition and rationally assessing needs are a pre-condition to receiving provincial funding. However, such studies are often confidential due to their use in allocation of funds at the provincial level. In Ontario, the provincial budget for municipal roads has declined in real terms since the mid-seventies (12). This may be due in part to increased amounts of preventative maintenance resulting in less reconstruction. Or it may be due to a decrease in new road construction. However, it may also be a result of an increase in deferred road maintenance due to budgetary constraints.

The Road Information Program of Canada (a committee of the Canadian Construction Association) estimates that in Manitoba some 600 miles of provincial trunk highways need repair annually at an annual cost of $100 million dollars over the next five years (23). A City of Edmonton road needs study showed that $1,034 million should be spent over the next 10 years. Of this amount at least one-half was for reconstruction and repair of existing roads and bridges while the rest was for new construction (48).

Summary of Canadian Situation

Isolated Canadian studies show that while all cities may not exhibit similar degrees of need in the same areas, almost all municipalities have some infrastructure needs which they are unable to satisfy. Similar to the U.S., it is anticipated that the primary problems facing Canadian municipalities are ongoing budget constraints and cutbacks. Fiscal restraint is tending to make many traditional maintenance procedures obsolete.

In Canada, lack of data makes it difficult to develop generalizations regarding the condition of municipal public works facilities and infrastructure. It is feared that the few locations which do commission studies and have implemented maintenance management systems are representative of only the relatively well-maintained cities. Those areas where very little data are kept may indeed represent a mounting backlog of needs. Experience in the older cities, both in North America and in Europe, should show us that the sooner the needs of infrastructure maintenance and reconstruction are addressed rationally, the less pressing those needs will be in future years.

A-4 What are Some Possible Remedies?

As shown by the work in the U.S., one of the primary causes of infrastructure deterioration is delayed maintenance due to revenue shortfalls. This results in two types of problems. The first is the inability to meet the backlog of needs that have built up over the years. In some locations these have reached crisis proportions. The successful elimination

of this backlog would bring all facilities up to an acceptable standard of service. The second problem is the inability to meet ongoing management and maintenance needs efficiently in order to maintain all facilities at an acceptable standard.

Obtaining sufficient revenues requires appropriate financial strategies. Achieving the most cost efficient repairs and rehabilitation schemes involves technical strategies. The relationship between policy makers and public works administrators will also have to be considered in order to avoid future problems. A detailed assessment of these strategies is beyond the scope of Phase I report, however, a brief overview of the major elements involved will be provided here, based largely on U.S. experience.

Financial Strategies

Currently, it appears that the long term maintenance of public works facilities is not a high priority with local politicians. Therefore, it does not compete well for budget resources against other items such as social services and recreation facilities. Over the past decade, the proportion of municipal budgets for public works has fallen (5). Revenue shortfalls mean a lack of revenue for ongoing maintenance, and repair and rehabilitation programs.

Initial investments in public works construction or reconstruction require large amounts of capital. Budget cutbacks have caused money previously available for capital works to be sidetracked for routine operations. Tight and unstable money markets have at the same time made the traditional means of raising capital very unappealling.

The problem of revenue shortfall cannot be solved by increasing general tax revenues. Increasing concern about local government spending is leading to "taxpayer revolts" such as the Proposition 13 referendum in California (16). Increased application of user fees has been suggested by many authorities as one means of increasing revenue (6, 4, 11). The concept of "user pay" has been well used in North America. Creative use of such fees could result in subtantial increases in revenues.

The most common application of user fees is a charge for the water supplied by the public works department. Sewer charges can also be levied based on water consumption rates. Other examples of user fees are toll roads and bridges, park entrance fees, and public transit charges. Some of

the less obvious examples of user fees are the collection of gasoline taxes and motor vehicle license fees which may be used to offset the costs of construction and maintenance of the roadway system.

With appropriate rate structuring, user fees can encourage conservation and efficient use of available facilities. However, because public services are generally in a monopoly situation, a great deal of care must be taken in setting rates that are equitable (21). Concerns for equity must enter into the general discussion on user fees. As pointed out by Lucy (13), user fees may be inequitable when considering various levels of ability to pay. Care must be taken in the search for additional sources of revenue, that the impact be distributed fairly throughout society.

Impost fees (a connection charge) may be levied to aid in offsetting the additional stress placed on the existing infrastructure by new development. Many Ontario municipalities have used impost fees or lot levies to obtain additional revenue to aid in the construction and expansion of various community facilities. Toronto, for example, uses impost fees to provide funds for the future expansion and reconstruction of municipal services (28).

Initial capital investments in municipal infrastructure are traditionally financed by borrowing (through municipal bond issues) and intergovernmental transfers such as matching grants and long term loans. With high rates of inflation and volatile interest rates, the availability of capital has been limited, especially to smaller municipalities. A number of remedies have been suggested in the U.S., some of which have more applicability there than in Canada (11, 6). A general outline of traditional and some creative financing alternatives is presented by the U.S. Government Finance Research Centre (42). Some alternatives to the traditional general obligation and revenue bonds are:

Zero Coupon bonds - similar to government savings bonds where interest payments are deferred until maturity.

Put Options and Warrants- greater flexibility to investors in the future buying and selling of bonds.

Short Term Borrowing	-	for interim financing during periods of high interest rates.
Leasing Schemes	-	lease purchase and sale -leaseback agreements. Private investors provide the capital facilities then lease them to the government.
Pension Fund Market	-	historically centred on stocks and bonds of major corporations but coming under pressure from labour and government to make "socially beneficial" investments.
Public-Private Partnerships		the privatization or contracting out of public services.
Bond Banks	-	smaller centres pool their needs into one large debt marketed by the bond bank.
Infrastructure Development Banks		make favourable interest loans capitalized by bond issues, government appropriations, revenues, and private investors.

These and other financial alternatives are only new in the sense that they have not been used to any great extent to finance public works projects by local governments.

Technical Strategies

Technical strategies for municipal infrastructure renewal and maintenance have to be implemented at local levels. The main elements include an initial and ongoing inventory and condition assessment, a means of determining the best time to repair or replace, and efficient technology to get the greatest amount of rehabilitation for a given unit cost.

The maintenance of roads and streets seems to have received more attention over the years than the maintenance of water and sewer lines.

Obviously road conditions are visible, whereas the condition of underground facilities are only apparent when they fail. Also, the tremendous increase in paved road construction in the post war decade has meant that a large number of streets and highways have now reached the end of their design lives of 15 to 25 years. Pavement management systems were developed during the past two decades to help cope with a deteriorating road system (33). The basic elements of this system are a careful and systematic inventory of road and pavement conditions coupled with established maintenance levels-of-service, i.e. the level or condition at which a particular maintenance activity should be completed. These levels-of-service influence work priorities and resource allocations (20). Knowing when to carry out a specific type of maintenance or rehabilitation and then doing so on time is the key to maintaining good roads at low cost. Deferred maintenance does not simply put off today's maintenance costs to tomorrow but actually increases costs. For road systems it has been found that pavement conditions get worse at an increasing rate with time. Lowest annual maintenance costs occur when resurfacing is carried out when roads are at their lowest acceptable condition i.e. before the point of incipient cracking (37).

The situation with regard to underground services is not as well defined because it is much more difficult to maintain up to date inventory and condition records. The design life of pipe materials may vary greatly and may be as long as 100 years (30). Estimating pipe condition by age alone is unrealistic. The actual life of facilities depends on many factors including original design, quality of construction, use, and maintenance as as well as the surrounding environment (17). Analysis of past maintenance records including information on the type of facility, its geographical location, the type of failure and the type of maintenance required can give estimates of present system conditions (24). Also important are leak detection surveys, flow monitoring surveys, closed circuit television inspections, and, in larger sewers, visual inspections (8, 15).

Combining this type of information with economic analyses of rehabilitation alternatives can give a rational, least annual maintenance cost system for determining work priorities and resource allocations (39).

Although there is still much research to do it is likely that some form of management system applicable to underground services analogous to the pavement management system can be developed.

Actual repair strategies for sewer and water pipes are developing quickly. The old and very costly solution of replacing broken pipe with new pipe may be used less frequently if older pipes can be rehabilitated. In Britain, where there is emphasis on sewer pipe rehabilitation, the existing "hole in the ground" is an asset to be exploited (35).

A brief list of rehabilitation methods includes (34):

- Chemical or cement grouting - stabilizes and strengthens the soil surrounding the pipe
- Chemical grouting of joints and small cracks
- Sliplining or pipe insertion
- Cured in place polyester resin lining
- Cement mortar lining
- Reinforced concrete placement

The best method to be used depends on a number of factors including:

- Structural condition
- Corrosive condition
- Cleaning requirements
- Extent of voids or washouts in the surrounding soil
- Potential settlement conditions.

The inventory and condition assessment of underground services make possible cost-effectiveness considerations of in-place rehabilitation rather than the replacement of broken pipes based on "crisis management" alone (3).

Administrator's Role in Local Government

Local governments are caught in the throes of an increasingly turbulent environment. Given the fiscal dependency of urban systems on other levels governments (through transfer payments and shared cost programs) cut-backs and restraint in budgets at the provincial and federal levels echo their way through to local governments. Growing opposition of taxpayers to increased government spending at all levels further reinforces current trends of retrenchment and restraint.

Budget constraints have forced many municipalities to shift from their former role of promoting development through the provision of services in anticipation of growth to a more conservative role of acting as a caretaker of existing services. This shift in orientation implies dramatic alterations in municipal service delivery policies and procedures. The new reality of "rising needs - declining resources" means that increasingly local governments and their administrative staff will be faced with conflict situations. Care must be taken in this environment to ensure that contemplated reductions in service levels are reasonable, equitable, and make long-term economic sense (32).

Municipal engineers, who have the responsibility of providing sound technical advice to their political masters, will have to make their voices heard above the tumult of other groups arguing for similarly pressing urban needs. The education and training of engineering staff must include communication skills to permit effective presentation of the needs of public works (9).

Public works administration is becoming increasingly complex. Technical and financial difficulties in achieving infrastructure renewal coupled with the need to coordinate activities with a multitude of other deparments (planning, finance, development) imply an increased reliance on technical advice. This places the political decision-maker in a position of greater dependence on the administrative staff. Without due care and sensitivity in developing appropriate council-staff relations, increased and unneccessary friction will emerge, particularly when faced with conflict situations (31).

In order to avoid conflicts and to be effective in providing municipal services, administrators must clearly recognize their role as policy advisors. Similarly, the elected officials must abide by their role as policy-makers and refrain from delving into administrative matters (10).

Achieving effective service delivery implies a partnership arrangement between the elected and appointed officials. Both must respect one another's political astuteness and technical competence. Establishing priorities for infrastructure rehabilitation and maintenance requires both a political and a technical input in order to function efficiently and rationally (10).

A-5 Research Activities and Needs

The shift towards fiscal restraint has encouraged the development of appropriate measures to efficiently provide municipal services. Budget constraints have forced municipal engineers to seek lower cost alternatives rather than capital intensive solutions to infrastructure problems. Rehabilitation rather than replacement has become the watchword in the municipal field.

Although the maintenance of existing physical plant has always been of some concern to municipal engineers, during the recent period of post-war prosperity most of the focus of research activities has been on the development of new facilities. Recently, however, there has been evidence of increased interest in research and publication in the maintenance and rehabilitation field. These endeavours are seeking to make existing systems more cost effective.

In spite of modest recent advances, more research work needs to be done. For example in the sanitary engineering field it has been estimated that about 80% of a community's investment in a sewerage system is in the underground pipe network. In spite of this, a review of published research in the water pollution control field revealed that only four percent of the research activities in 1979 dealt with the piped portion of the sewer system (32). Cost effectiveness implies that more attention must be paid by researchers to those elements of municipal infrastructure which are most

costly.

The following sections provide a brief review of evolving maintenance and rehabilitation approaches in municipal infrastructure as well as an indication of future research needs.

Roads and Streets

One of the most visible elements of municipal infrastructure is the roadway system. In their efforts to reduce congestion and traffic loading on existing roads, transportation engineers are turning to demand management techniques such as:

- making more efficient use of existing streets by providing preferential treatment for buses, improved parking regulation, and computerized traffic control.
- reducing vehicle use in congested urban areas through the use of carpools, tolls, and auto restricted zones.
- improving public transit services with express bus services, park and ride stations, and more efficient and equitable fare policies (7).

With respect to pavement surfaces a good deal of research work has already been done by way of initiating the use of pavement management systems. Although this maintenance management approach provides a rational means of priorizing activities, more research and development is required on the design and construction of the pavement elements. Areas requiring further investigation include:

- construction and rehabilitation practices: how is improved ductility reintroduced into aged pavements? Higher penetration grade bitumen improves ductility but often at the expense of density: would improved rolling and compaction techniques resolve this problem?

- pavement strength is weakened through surface water penetration into the base material: how can a pavement be made watertight? Would improved crack-sealing techniques extend the life of existing pavements?

- can current pavement recycling techniques be made more efficient?

A relatively high percentage of municipal public works budgets are devoted to roadway systems. Further research into the many elements involved in roadway and pavement maintenance may result in more effective use of increasingly scarce revenues.

Water Distribution Systems

Similar to the wastewater collection system, most of a community's investment in a water supply and distribution network lies in the piped system. One means of effectively reducing operating costs is reducing the number of leaks within the distribution network. In most urban water distribution systems a considerable loss of treated water occurs from joints and cracks in the watermain and laterals. In may cases this water loss goes undetected as it flows either to the groundwater table or into the sewer collection system as a source of infiltration. A variety of leak detection methods are available including flow measurements and the use of "geo-phones" to hear the pressure leaks in the system.

Other maintenance concerns within water pipes include bacterial build-up and the growth of tuberculation (calcite and other chemical deposits) on the inside of the pipes. The former poses a health hazard while the latter effectively reduces the hydraulic flow capacity of the distribution system. One means of cleaning the bacterial deposition and possibly improving hydraulic flows is through the use of foam swabs injected into the system under controlled conditions (36). Other more expensive and difficult water main cleaning systems include the use of steel "scraper pigs" and cement relining of the cleared pipe.

Further research needs in the water distribution field include:

- developing appropriate, low cost methods of leak detection, particularly under winter conditions.
- devising techniques of strengthening existing piping to reduce fractures and cracking, again particularly under winter conditions.
- testing and developing low cost techniques for water main cleaning, particularly for improved hydraulic flow capacity.

Sewerage Systems

In many of our older urban centres, the urban drainage system is combined to handle both wastewater and stormwater flows. As urbanization has continued the problems of limited capacity in these combined sewer systems have been exacerbated by:

- increased discharge demands being placed on the existing collection facilities without adequate additions or enlargements.
- urban development increasing the amount of impermeable area in the watershed area resulting in higher levels of rainfall runoff.
- older urban sewers, often brittle vitrified clay pipe, being cracked and broken by increased traffic loading and vibrations.
- increased levels of groundwater infiltration into cracked and broken sewer pipe leading to higher levels of flow.
- general neglect of the system resulting in a build-up of roots and debris effectively reducing the system's hydraulic carrying capacity.

In the U.S., the federal government has estimated that it would cost more than $26 billion to separate combined sewer systems in urban areas (44).

Fiscal restraint is forcing municipalities to seek low cost solutions to the problems of flooding and overflow from combined sewer systems. The U.S. Government is encouraging the use of a Best Management Practice (BMP) approach to reducing costs. BPM entails a systematic review of the collection system to identify lower cost alternatives to sewer separation. Some of these alternatives include the development of source controls (delaying stormwater entry into the collection system to reduce peak loading), collection controls (regulating the flow within the system to maximize capacity), flow regulators (installing devices to shift or speed flow in the system), and treatment techniques at overflow discharge points (44).

Using a similar systematic approach, Theil has argued that careful planning and layout of new land developments could permit urban streets to function as major stormwater collectors discharging at designated locations along a receiving stream. Using the roadway system for major storm flows allows the installation of smaller, less expensive minor storm sewer systems (22).

Concerns for improving the efficiency of wastewater collection systems has led to the development of techniques to reduce the amount of stormwater inflow and groundwater infiltration in the system. A wide variety of tools are available to the municipal engineer concerned about inflow/infiltration problems. Existing sewer conditions may be examined visually with an in-place television camera, identified infiltration cracks and joints can be sealed, in-place, with a high pressure chemical grout, and the entire sewer system may be cleaned with a high pressure hydraulic sewer flusher (38).

Rehabilitation approaches have been developed in North America and Europe. These include relining existing pipes with long length plastic tubes, inversion lining with a resin impregnated felt tube, and shell and plate lining in man-entry sewers. A variety of other techniques are being tested, particularly in Europe (29).

Advances in sewer maintenance technology have led to a reconsideration of design standards. Increasingly municipalities are allowing the installation of curvilinear sewer pipes and increasing mandatory manhole spacing (22).

All of these research endeavours should lead to improved sewer rehabilitation techniques and more effective use of scarce revenues.

REFERENCES

A. Books

1. Choate, P. and S. Walters, America in Ruins: Beyond the Public Works Pork Barrel, The Council of State Planning Agencies, Washington, D.C., 1981.

2. Hatry, H.P. et al, Capital Investment Priority Setting for Local governments, The Urban Institute, Washington, D.C., 1983.

3. Hatry, H.P. and B. Steinthal, Selecting Capital Facility Maintenance Strategies, The Urban Institute, Washington, D.C., 1982.

4. Rebuilding America's Vital Public Facilities, The Labour Management Group, New York, 1983.

5. Revenue Shortfall: The Public Works Challenge of the 1980's, Task Force on Revenue Shortfall, American Public Works Association, Chicago, 1981.

B. Technical Articles

6. Choate, P., "The Case for a National Public Works Bank", Water/Engineering and Management, Scranton Gillette Communications Inc., Des Plains, Ill., April, 1983.

7. Gakenheimer, R., "Urban Transportation Planning in Transition", American Institute of Planners Journal, January, 1979.

8. Hollenbeck, A.J. and R.J. Nogaj, "Inflow Distribution in Wastewater collection systems", Water/Engineering and Management, Scranton Gillette Communications Inc., Des Plains, Ill., Jan., 1983.

9. Ircha, M.C., "Municipal Engineering: Shifting to a Maintenance Perspective", Engineering Education, ASEE, May, 1982.

10. Ircha, M.C., "Working with Council: A Staff Perspective", Municipal World, October, 1983.

11. "Infrastructure Solutions for Financing", Engineering News Record, McGraw-Hill, New York, March 3, 1983.

12. "Infrastructure Solutiors for Utilities", Engineering News Record, McGraw-Hill, New York, April 7, 1983.

13. Lucy, W., "Equity and Planning for Local Services", American Institute of Planners Journal, April, 1981.

14. Manual of Sewer Condition Classifications, Standing Committee Technical Report #24, National Water Council, London, 1980.

15. Mayer, E.E. et al. "The Economics of Leak Detection and Repair", American Water Works Association Journal, AWWA, Denver, Jan., 1981.

16. Obering, R.D., "Revenue Shortfall - Taxpayer Revolt", APWA Reporter, American Public Works Association, Chicago, April, 1982.

17. O'Day, D.K., "Analyzing Infrastructure Condition - A Practical Approach", Civil Engineering, American Society of Civil Engineers, April, 1983.

18. "Report on Assessment of Technologies and Costs for Publicity - Owned Treatment Works", Metcalf and Eddy, Boston, 1975.

19. Sewers and Watermains - A National Assessment, Study Committee on Sewers and Watermains, National Water Council, London, 1977.

20. Shahin, M.Y., "Components of a Maintenance Management System", Transportation Research Record 781.

21. Stanley, R.H. and R.L. Luiken, "Water Rate Studies and Rate Making Philosophies", Public Works, Public Works Journal Corp., Ridgewood, N.J., May, 1982.

22. Theil, P., "A New Approach to Engineering and Planning for Land Development", Paul Theil Associates, Bramalea, Ontario, 1975.

23. TRIP/Canada, "An Evaluation of the Extent of Substandard Roads in Manitoba", Canadian Construction Association, Ottawa, 1983.

24. Walski, T.M., "Economic Analysis of Watermain Breaks", Water Works Association, Journal, AWWA, Denver, March, 1982.

25. "Water Utility Data", The American Water Works Association, 1981.

C. Conference Papers

26. Andersen, E.B., "Investigation of Sewage Failure in Denmark", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

27. Balmer, R. and K.G. Meers, "Surveying Severn-Trent's Sewer", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

28. Bremner, R.M., "A Method of Sewer Rehabilitation - the Toronto Experience", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

29. Cox, G.C., "Making Use of the Hole: New Techniques for Sewer Renovation", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineering, London, 1982.

30. Cullen, N., "The Sewer Dereliction Problem - Evidence from Collapse Studies", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

31. Ircha, M.C., "The Municipal Engineer in the Micro World of Local Government", paper presented at the Canadian Society for Civil Engineering Conference, Fredericton, N.B., 1981.

32. Ircha, M.C., "Municipal Utility Systems: Emerging Trends in Management and Maintenance", Planning and the Civil Engineer, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

33. Keyser, J.H., "A Practical Management System for Pavement Design and Maintenance", paper presented at the American Public Works Association Congress, Atlanta, 1981.

34. Ouellette, H. and R.J. Schrock, "Rehabilitation of Sanitary Sewer Pipelines", Proceedings of the American Society of Civil Engineers, Vol. 107, No. TE4, July, 1981.

35. Reed, E.C., "The Assessment of the Problem in the U.K., Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

36. Regts, E.H. and Ircha, M.C., "Use of Polyurethane Foam Swabs for Cleaning Water Distribution Systems", Proceedings, Ontario Section, American Water Works Association, Toronto, 1971.

37. Sheflin, M.J.E., "Your choice - Bad Roads at High Cost or Good Roads at Low Cost,", paper presented at the Asphalt Conference, Fredericton, N.B., 1981.

38. Sullivan, R.H. and Foster, W.F., "Status of Sanitary and Combined Sewer Systems in the U.S.A.", Restoration of Sewerage Systems, Proc. of an International Conference, Institute of Civil Engineers, London, 1982.

39. Walski, T.M., "Economic Analysis of Rehabilitation of Watermains", Proceedings of the American Society of Civil Engineers, Vol. 108, No. WR3, Oct., 1982.

D. Government Documents

40. "Capital Budgeting and Infrastructure in American Cities: An Initial Assessment", a joint survey conducted by the National League of Cities and the United States Conference of Mayors, 1983.

41. "Financing Infrastructure for Economic Development", Government Finance Research Center, Washington, D.C., 1983.

42. "Financial Statement of Accounts - Ontario", 1968, 1975,1983 Ontario Ministry of the Treasury, Economics and Intergovernmental Affairs.

43. "Industrial Location Determinants, 1971-1975", United States Department of Commerce, Washington, D.C., 1973.

44. "Large Construction Projects to Correct Combined Sewer Overflows are too Costly", United States Comptroller-General, Washington, 1979.

45. MacLaren, J.W., "Report to the Ministry of the Environment of the Province of Ontario on a Water Distribution and Sewage Rehabilitation Program for Ontario Municipalities", unpublished.

46. National Inventory of Municipal Waterworks and Wastewater Systems in Canada, 1981, Minister of Supply and Services Ottawa, 1982.

47. Peterson, G., "Fiscally Distressed Cities", Hearings on Local Distress, State Surpluses and Proposition 13, Committee on Banking, Finance and Urban Affairs, Washington, D.C., 1978, pp. 83-90.

48. "The City of Edmonton Road Needs Study, 1981", Pavement Management Group, City of Edmonton, 1982.

49. The Status of the Nation's Highways: Conditions and Performance, Federal Highway Administration, January, 1981, pp. 74-75.

E. Newspaper Articles

50. "Lalonde Cooling to Prime Minister's Public Works Plan", Globe and Mail, March 2, 1983, p.2.

51. "Mayors and Industry Back Public Works to Spur Economy", Vancouver Sun, Dec. 18, 1982, p. A-14.

52. "Power Failure", New York Times. Nov. 10, 1965.

53. "Sewer Water Projects Expand to Ease Layoffs", Winnipeg Free Press, Aug. 19, 1983, p. 3.

APPENDIX B

EUROPEAN MUNICIPAL INFRASTRUCTURE

by

W.H. Curtis, City Engineer, City of Vancouver

Introduction

In the spring of 1984, the American Public Works Association, the U.S. National League of Cities and the Federation of Canadian Municipalities together with other organizations, sponsored a series of seminars and works tours in England, France, Germany and the Netherlands. The European equivalents of the above organizations, and senior public officials from the various countries visited, participated in the discussions. Mr. J. Martin, President of the APWA, headed the seminars. Mr. W. Curtis, Chairman of the FCM Technical Committee on Urban Infrastructure, was involved. The purpose of the seminars was to examine European methods of dealing with infrastructure problems, new technology applicable to infrastructure maintenance and innovative funding methods. Stockholm, Sweden, where the climate is similar to that in Canada, was also visited by the Canadian representative.

As could be expected, there is considerable variation in infrastructure conditions and funding methods among the countries visited. These are described below for each country individually. However, some common characteristics are:

1. Although European cities have had difficulty in keeping up with new capital works, they have managed their maintenance and replacement works well. Generally the condition of existing facilities seems to be better than in Canada and officials report less backlog of work.

2) There is more involvement of Central or Federal Government in local maintenance funding than in Canada. Various grant and assistance programs exist. There is also more central government control and decision making and less local government autonomy.

3) European local governments are involved in more services than in Canada. An example is housing in England. In an effort to reduce government burden, there is a trend to privatization of such services in some European countries.

4) Some European cities are involved in enterprises such as banking, mining, etc. These provide profits which can be used to offset costs of some services provided by local government. These constitute funding sources not available in Canada.

5) European central governments are now exerting pressure on local governments to hold down rates and taxes in order to control inflation. This is now resulting in the growth of maintenance backlogs. However, this trend is more recent than in North America and less backlog has developed so far. Local government officials indicated that they expect problems to grow now.

6) Except for one in England, there were no comprehensive national studies of infrastructure available for European countries.

7) European cities are trying to establish computerized information systems for management of infrastructure. In this regard, they are not as advanced as North American cities.

England

In England the amount of central government assistance to local government for infrastructure work is considerable - more than in Canada. Such programs as the "Rate Support Grants" and the "Transport Supplementary Grants" play a significant role in funding works. Sewer and water systems have been funded through user charges which are controlled by the central government. Road works are financed from local general revenue. Until the late 70's funding was generally adequate for maintenance and replacement works. Some backlog was developing in government owned housing.

In recent years the central government has legislated controls on user rate charges and has restricted grants to municipalities. Local government spending has dropped to 13% of GNP. Total funding for new infrastructure construction work (including housing) has dropped from 9.9 Billion (Pound Sterling) per year to 5.8 Billion Pounds per year in the period 1971-81. On the other hand funding for repair work has risen slightly from 3.4 Billion Pounds to 3.8 Billion Pounds in constant 1975 Pounds. The restrictions and local government funding shortfalls are resulting in a deferral of work and a backlog is building up.

The Institution of Civil Engineers, through its Infrastructure Planning Group, has carried out a national study and has published its first report in January 1984. The study covers water, energy, urban renewal, housing and transportation. Sewers were not included except that the report has recognized that "funding should be increased to replace derelict sewers" and has recommended a survey of condition immediately.

A significant backlog of maintenance and rebuilding has occurred in housing. The water system has "a problem of considerable magnitude". Restrictions in sewer and water user rates are necessitating deferral of work.

Generally roads have received better maintenance in recent years. The major highways are in good condition. The roads in worst condition are "principal roads in urban areas". Current expenditures in this area are inadequate to keep up with the maintenance of these. It appears the backlog of work has not built up to the extent it has in Canada and the U.S.A.. However, it exists and is growing.

To reduce government costs there is a current drive to privatize housing. Private housing has increased considerably from about 20% ten years ago to a projected 80% by 1990. The central government is also attempting to reduce the size of government. In London there is a proposal to eliminate the regional government council and replace it with functional boards such as a New Transit Board. Local governments would be retained and would relate more closely to the central government.

France

There has been a shortage of funding for new capital works in France but funding for maintenance work has been adequate until recently. Sewer and water systems are financed through user charges and there has not been a large problem in raising necessary maintenance and replacement funding from this source. Roads and bridges are financed from general revenue.

The central government as well as the large "Regions" contribute funding to local governments through grant and cost sharing programs. These are usually directed to capital rather than maintenance works but this permits the local governnents to focus their own funding on maintenance. For recent flood control works in Paris funding was: Central Government 30%, Region 10%, Road Authority 40% and City 20%.

About two years ago the central government began restricting grants in an effort to curb inflation. It also imposed limits on sewer and water rates. In 1983 the increases in rates were limited to 7% when inflation raised costs by 8%. As a result deferral of work is occurring and a backlog is building up. This situation has only existed for two years and the condition of infrastructure is still good. Officials feel that deterioration will become more pronounced if restrictions on rates and grants continue.

No comprehensive national studies or surveys of infrastructure condition were available. Individual functions are examined periodically by various ministries to determine adequacy. Although direct comparison of condition with Canada is difficult, visual examination and discussions with responsible French officials indicate that the condition of infrastructure is generally better than in Canada. Deferral and deterioration are now occurring but the process is recent. Problems relate to central government attempts to curb inflation rather than to public resistance to local government taxation.

In Paris access to utilities for maintenance purposes is facilitated by using common ducts under sidewalks which permit ready access and inspection. These are more expensive initially but save maintenance costs later. Traffic disruption is also reduced since the travelled portion of the street need not be torn up for utility repairs.

In Paris, parking inadequacy has been a serious problem for many years. There is a growing trend to drive downtown in spite of an excellent metro and bus system and it has been necessary to restrict available parking in some areas to local residents. To provide parking the city has permitted private companies to construct garages under city property, including streets where utility disruption can be accommodated. The private companies operate the lots to recover capital

and operating costs. After 30 years ownership they are turned over to the city. In the interim the garages are taxable. Space for such garages is now very scarce in the central city and such private ventures are no longer economic - even with free city land. The city has had to subsidize parking further by constructing garages in joint ventures with private companies. Thus, this privatization program which has taken considerable burden off local government is now in some difficulty.

Germany

About 75% of infrastructure costs are provided from central government grants to local governments. There has not been a resistance to local government taxation comparable to that in Canada and the USA. Sewer and water works are financed through user charges and, so far, there are no central government restrictions on rates. As a result, maintenance and replacement have been adequate until recently. Officials feel there is not a very large backlog of work yet.

There is now growing public pressure to hold down government budgets - particularly at the central government level. Since funding for roads and bridges is derived largely from central government grants, road maintenance is now being affected by restrictions on grants. Officials feel funding is now inadequate and deferral of works is resulting in a backlog of work. Another area where there is revenue shortfall is in public transit. About 40-50% of necessary funding comes from fares and the remainder must be raised by government.

German municipalities are involved to a much greater extent than in Canada in various forms of business such as banking, mining, power etc. Profits from these ventures are used to offset transit deficits. Cities can cooperate in joint ventures which require more capital than each could raise individually. Consequently, local government is involved in very substantial business enterprises.

Another approach which German cities are using to reduce local government burden is privatization. In Germany, public employees have higher wage rates than private employees and privatization can reduce costs. Officials also feel productivity is higher in some private sector areas. Functions which are being privatized are parks maintenance, security in public buildings, janitor services and refuse collection. Refuse collection has been privatized primarily in small cities. Large cities with substantial fleets still maintain public collection. German officials feel privatization has benefits in some cases but is not a panacea.

A comprehensive national survey of infrastructure condition has not been carried out. German officials indicate that the condition of roads is poorest, followed by sewers with water systems in the best condition which is very similar to the situation in Canada but opposite to that in England. In general, infrastructure condition is better than in Canada or the USA and large backlogs of works have not developed yet.

The Netherlands

The central government plays a very important part in the construction and maintenance of urban infrastructure. For "current" work involving maintenance and replacement the central government provides about 92% of required funding. 30% of this is in the form of general purpose grants which cities can use in accordance with their own priorities and 60% is in the form of special grants which are used for specific purposes. After a city has provided its 8% of the funding, it can apply for further "supplemental" grants if it is still incurring deficits. Sewer and water works are largely financed from user charges.

Sources of funding for "capital" works are about 40% from direct taxes, 20% from borrowing and the remainder from other sources such as land sales (reclaimed lands, etc.). Borrowing is permitted only for capital work. All current work must be funded directly.

There is a municipal bank of the Netherlands (BNG) which is 50% controlled by central government and 50% by local government. Its purpose is to loan funds to local government in direct competition with private banks. Funding is derived from bond issues. This arrangement seems to be working well.

Housing is an important government function representing 1/3 of government expenditure. Local government expenditures are about 15% of GNP at present. There is a housing shortage in large cities such as Amsterdam and government involvement in this area affects funding available for other forms of urban infrastructure.

As in other European countries, central government is now tightening up on expenditures. Grants are being restricted and a backlog of work is occurring. Public involvement is a significant factor in the Netherlands. A local government decision on infrastructure work can be appealed first to the provincial government and then to the central government - in some cases delaying projects for many years. Environmental considerations are also a major and growing factor. For example, the Oosterschelde flood control project was completely revised from a fresh water concept to a salt water concept for environmental reasons.

Although there is no national study of urban infrastructure in the Netherlands, officials there, as well as visiting officials, felt the condition of existing infrastructure is generally better than in Canada. Due to slower growth it has been possible to devote more funding to maintenance and replacement. Recently, in an effort to reduce unemployment the central government has been promoting work in labour intensive areas such as road works. This may be effective in slowing deterioration of these facilities.

Sweden

There is less central government involvement in local public works than in other parts of Europe. Construction and maintenance of local urban roads are financed entirely by local government. Central government shares in 50% of costs of major through-roads passing through Stockholm. Funds are raised by local government for maintenance by direct taxation and for construction of new capital works by borrowing. Sewer and water systems are financed through user charges which are currently held down in keeping with national restraint measures.

In Stockholm, difficult economic conditions have resulted in insufficient funding to maintain the street system. Dramatically rising social costs (e.g. day-care centres and welfare costs) have reduced funds available for road maintenance, and officials are concerned that lack of maintenance is resulting in premature total rebuilding, which is much more expensive. A more severe climate, comparable with that in most parts of Canada, and extensive use of studded tires (60% of cars) is causing serious deterioration of road surfaces.

Sewer and water treatment and production sytems are modern and in good condition. The collection and distribution systems are old and in need of repair. Control of sewer and water rates to 4% increase per year has resulted in insufficient funding for adequate maintenance. System replacement is currently on a 250 year cycle which far exceeds the life expectancy of 50 - 75 years. Thus, a backlog of sewer and water work exists.

Funding is now being diverted from sewer treatment plants to more urgently needed collection system works. There is a move by officials to implement computerized information systems and to set standards for maintenance. Public and political awareness of the infrastructure problem is growing. The central government is currently using road works for creating employment, but this is largely in non-urban areas so far.

APPENDIX C

SAMPLE QUESTIONNAIRES

AND

FOLLOW-UP LETTERS

(Mayors' Presurvey - pages 1-4)

(Infrastructure Survey - pages 5-22)

(Follow-up Letters - pages 23 - 25)

FCM

C1

Dear Mayor and Council:

RE: CANADIAN INFRASTRUCTURE TASK FORCE

During the past ten years, and particularly during this recession, the sewer, water, bridge, street, parks, library, harbour, goods movement, exhibition, flood protection, public transportation, recreation, special care, social service and other facilities which make up our urban infrastructure have begun to fall into disrepair in many parts of Canada. Should this process be permitted to continue, the situation could be reached where it would be beyond the financial means of many cities to recover from the backlog of repair and replacement work necessary to bring the infrastructure back into a reasonable condition.

It is important, therefore, that we know what the status of our infrastructure is today, and that we begin to develop programs which would ensure that our infrastructure is protected. The economic health of our cities and, in fact, of our country is related to the state of our infrastructure. This is a public sector issue with implications for all orders of government.

Our American neighbours have already recognized this and are beginning to address the problem. The FCM has also recognized the situation and has created an Infrastructure Task Force of which I am Chairman. Our job is to determine the status of our infrastructure and to develop policy recommendations and programs designed to correct any problems which are identified. The attached article from the USA illustrates some of the things they are doing about their problems.

...2/

Federation of Canadian Municipalities
Fédération canadienne des municipalités
1415 112 Kent Street
Ottawa, Ontario
K1P 5P2
(613) 237-5221
Telex 053-4451

His Worship J. J. Brady
Calgary, Saskatchewan
President
Président
Alderman D. A. Lawson
Burnaby, British Columbia
First Vice-President
Premier vice-président
His Worship M. Dewar
Ottawa, Ontario
Second Vice-President
Deuxième vice-président
His Worship P. J. Moran
Charlottetown, P.E.I.
Third Vice-President
Troisième vice-président
Jean Bourassa J. Pelletier
Quebec, Quebec
Past-President
Président sortant
James W. Knight
Executive Director
Directeur général

An international study on municipal infrastructure was carried out by the American Public Works Association. It showed that maintenance of the infrastructure in both American and Canadian cities has fallen behind. That study was carried out before the recession. We propose to determine, through a survey, how severe the problem is in Canadian cities at this time. To this end, I am forwarding a short questionnaire to determine: a) whether your city would like to participate in such a study; b) if so, whether you would be able and willing to contribute information on the state of your infrastructure and funding availability; c) who in your organization might coordinate your city's input.

Once we have the survey information, the FCM Task Force will be able to analyze it and produce literature designed to assist all urban areas in dealing with the problems identified and to generate a co-ordinated public sector response.

Would you please take the trouble to fill out the questionnaire and forward it to Mr. Jim Knight, Executive Director, Federation of Canadian Municipalities, Suite 1318 - Tower B, Place de Ville, 112 Kent Street, Ottawa, Ontario K1P 5P2.

I am sure that your contribution will significantly add to the value of this study and contribute to the betterment of urban areas in Canada.

Yours truly,

Michael Harcourt

Michael Harcourt
Mayor of Vancouver
Chairman, FCM Task
Force on Infrastructure

Enclosures

MAYORS' SURVEY OF THE IMPACT OF REVENUE SHORTFALLS ON THE MAINTENANCE OF THE MUNICIPAL INFRASTRUCTURE

The Federation of Canadian Municipalities has established a task force to examine the impact of revenue shortfalls on the maintenance of our urban infrastructure. The purposes for this preliminary survey of Mayors are to obtain your perceptions on infrastructure problems and to establish a contact person in your organization for a more detailed follow-up survey. Your answers to the following are appreciated:

1. To what extent do you feel that funding for the maintenance of your infrastructure is being achieved?

☐	☐	☐	☐	☐
full funding	considerable funding	half funding	considerable underfunding	no funding

Comment _____

_____

2. Which of the following services in your municipality are deteriorating?

☐ none ☐ sewer ☐ water ☐ power

☐ communications ☐ lighting ☐ pavements, bridges & walks

☐ libraries ☐ parks ☐ flood protection ☐ public transportation

☐ other

Comments _____

3. What economic strategy do you feel has the most potential in dealing with infrastructure problems in your area?

☐ debt financing ☐ pay-as-you-go ☐ user fees

☐ other _____

Comment _____

_____

C4

4. Are you willing to have your municipality participate in a national survey and receive survey results.

☐ Yes ☐ No

If Yes, please suggest a resource person who will provide relevant statistics on your urban infrastructure:

Name _____

Position _____

Address _____

City _____

Province _____ Postal Code _____

Your comments on the need for an inventory on the status of the Municipal infrastructures, appropriate standards of maintenance, and policies on economic strategies are appreciated.

_____

_____

_____

_____

_____

_____

_____

Mayor's Signature _____ Municipality _____

C5

FCM

February 16, 1984

Dear

RE: SURVEY OF MUNICIPAL INFRASTRUCTURE

In December, 1983, I wrote to your Mayor and Council, as Chairman of the Federation of Canadian Municipalities' Task Force on Infrastructure, requesting participation of your municipality in this study. Since then, a technical committee has been established comprised of senior administrators and chief engineers from across Canada (see attached list). The committee has recommended that in order to assess the seriousness of infrastructure problems in Canadian municipalities, a survey be undertaken to establish the status of our infrastructure as well as funding trends and deficiencies, if any. To achieve this aim, the technical committee has prepared the accompanying questionnaire which we would very much appreciate your completing as soon as possible.

The survey has two parts. The first deals with general questions designed for senior administrators. The second involves more detailed questions which you may wish to send to the departments and branches within your organization that have readily available detailed data on such matters as water, sewers, streets and bridges.

We realize that different communities utilize different inventory formats and methods for determining infrastructure deficiencies and priorities for dealing with them. Nonetheless, we ask that you answer as many questions as possible using the format provided.

.../2

Federation of Canadian Municipalities
Fédération canadienne des municipalités

1318-112 Kent Street
Ottawa, Ontario
K1P 5P2

(613) 237-5221
Telex 053-4451

His Worship E.J. Brady
Carlyle, Saskatchewan
President
Président

Alderman D.A. Lawson
Burnaby, British Columbia
First Vice-President
Premier vice-président

Her Worship M. Dewar
Ottawa, Ontario
Second Vice-President
Deuxième vice-président

His Worship F.J. Mooma
Charlottetown, P.E.I.
Third Vice-President
Troisième vice-président

Son honneur J. Pelletier
Québec, Québec
Past-President
Président sortant

James W. Knight
Executive Director
Directeur général

C6

Because we hope to have the analysis and report completed for the FCM conference in early June, we are requesting that you return the completed questionnaire by March 15, 1984. Survey results and a summary of the analysis will be sent to you.

The overall study will be divided into two phases. The purpose of the first, which will be the product of this survey, is to ascertain the general status of specific infrastructure systems (i.e. sewers, waterworks, roads and bridges), funding trends and related problems and to outline potential solutions. In Phase II, which will get underway this summer, the results of Phase I will be refined, additional infrastructure systems will be examined and recommendations pertinent to municipalities across Canada will be drawn up.

Please note that the survey will be completely confidential and no individual municipal area will be identified.

Thank you very much for your attention to this request. We look forward to hearing from you.

Yours sincerely,

Michael Harcourt

Michael Harcourt
Mayor of Vancouver
Chairman, Task Force
on Infrastructure

MH:JD
Enclosure

C7

MUNICIPAL INFRASTRUCTURE SURVEY

Senior Administrator

Name: _____ Title: _____

Address: _____

_____ Phone: ( ) _____

Please note that in this survey, the term "expansion", as used to refer to completely new systems or facilities built in new areas of a community, is not considered. All other aspects of infrastructure construction, maintenance and operation should be included in your responses whether customarily referred to in your jurisdiction as "repair", "replacement", "rehabilitation" or even "expansion".

We ask that if your data keeping methods preclude your completing portions of the survey using the format provided, you explain as fully as possible your own procedures for keeping track of infrastructure conditions and status, for identifying deficiencies and determining repair or replacement priorities.

The first page of the attached survey might best be completed by senior administrators. The remaining portions (pages 2-15) may be passed on to appropriate staff members for completion.

The fully completed form should be returned by March 15, 1984 to:

INFRASTRUCTURE TASK FORCE
Federation of Canadian Municipalities
1318 - 112 Kent Street
Ottawa, Ontario
K1P 5P2

Thank you for your participation in this effort.

MUNICIPAL INFRASTRUCTURE SURVEY

(To be completed by Senior Administrator)

1. Name of Municipality _____

* Note: 1983, 1976 & 1968 data requested. If not available, note date of preferred year.	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
2. Population			
3. Municipal Budget(Million $):			
- Total Operating Budget			
- Public Works Operating Budget (excl.debt charges)			
- Debt Charges on Public Works Facilities			
- Total Capital Budget			
- Public Works Capital Budget			
4. Liability Claims:			
- number			
- payouts in $			

5. If you feel you have an infrastructure problem, how would you rank the following impediments to successful rebuilding and protection of your infrastructure? (1 = greatest impediment, 5 = least impediment)

funding shortage ☐
prolonged public involvement ☐
lack of staff for problem analysis ☐
political inaction ☐
bureaucractic delay (red tape) ☐
others (explain)_____ ☐

6. Please provide comments regarding the present condition of your municipality's infrastructure and the problems and successes you have had in trying to manage it. As well, please identify infrastructure deficiencies in your community which have slowed or impeded economic development.

MUNICIPAL INFRASTRUCTURE SURVEY (Continued)

6.* In your opinion, the present condition of your facilities:

1 is good, 2 is acceptable, 3 needs some repairs, 4 needs extensive repairs,
5 is not acceptable or 6 is not under municipal jurisdiction, not existing, or not applicable.

Municipal Facilities	* Present Condition	Average Age (years)	Rank Priorities for Capital Expenditures (1,2 & 3)	Change in condition over the last 15 years (check one)		
				improving	about the same	getting worse
Water Supply, Treatment & Storage						
Water Distribution						
Sanitary & Combined Sewerage Collection						
Sewage Treatment						
Storm Sewer						
Roads						
Sidewalks						
Traffic Control Equipment						
Transit						
Bridges						
Solid Waste Disposal Facilities and Resource Recovery Facilities						
Public Buildings						
Parks & Recreational Facilities						
Theatres and Museums						
Community Social Service Facilities (e.g. libraries senior citizen centres, day care centres)						
Others _____						

SEPARATED AND COMBINED SEWER SYSTEM

COLLECTION SYSTEM

* Note: 1983, 1976 & 1968 data requested. If not available, note date of preferred year.

	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
1. Total System Length (km) (excluding service connections and forcemains)			
Length of: - combined (km)			
- separated sanitary (km)			
storm (km)			
- force mains (km)			
2. % of Population Connected			
3. Av. Daily Flow (1000 m^3/day)			
4. Number of Emergency Repairs (Breaks, Blockages)			
5. Number of Days in Year System Surcharged			
6. Design Storm (Years)			
B. Annual Cost of:			
7. Emerg. Repairs (1000 $)			
8. Scheduled Repairs/ Rehabilitation (km)			
(1000 $)			
9. Pipe Replacement (including manholes) (km)			
(1000 $)			
10. Cleaning and Inspection (km)			
(1000 $)			
11. Routine Operat. & Maint. (1000 $)			
12. Administration (1000 $)			
13. Other_____(1000 $)			
14. Total Sewer System Budget (1000 $) (excluding new construction for expansion)			
15. Liability claims: No.			
Payouts (1000 $)			

SEPARATED AND COMBINED SEWER SYSTEM (Continued)

C. Revenue

Source of Revenue for Operation, Replacement and Rehabilitation of Separated and Combined Sewer System

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,

Provincial Subsidy ____ %, Federal Subsidy ____ %,

Other (explain) _____ ____ %

D. Needs

16. What standard or deficiency measure do you use to determine whether your collection system is functioning at an acceptable level?

_____

_____

17. a) How many km of separated (total of sanitary plus storm) and combined sewers need replacing now due to lack of capacity or deterioration? _____(km).

b) Total cost to bring separated and combined sewers up to an acceptable level (at a unit cost of $_____ per km) is _____. (1000 $)

18. Design life for new installations _____(years).

19. Total Collection System Replacement Value _____ (Million $, 1984)

Please attach any further information you may have available.

SANITARY TREATMENT FACILITIES

1. Brief Description of Treatment and Disposal Facilities _____

_____

_____

* Note: 1983, 1976 & 1968 data requested. If not available note date of preferred year.	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
2. Treatment Capacity (1000 m^3/day)	_____	_____	_____
3. Number of days that sewage flows exceeded treatment system capacity	_____	_____	_____
4. No. of emergency repairs	_____	_____	_____
B. Annual Cost of (1000 $)			
5. Preventive Maintenance	_____	_____	_____
6. Routine Operat.& Maint.	_____	_____	_____
7. Emergency Repairs	_____	_____	_____
8. Administration	_____	_____	_____
9. Other _____	_____	_____	_____
10. Total Treatment Facility Budget (excluding new construction for exparsion)	_____	_____	_____

C. Revenue

11. Source of Revenue for Operation, Replacement and Rehabilitation of Treatment and Disposal System :

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,

Provincial Subsidy ____ %, Federal Subsidy ____ %,

Other (explain) _____ ____ %

SANITARY TREATMENT FACILITIES (Continued)

D. Needs

12. What standard or deficiency measure do you use to determine whether your treatment facilities are functioning at an acceptable level?

_____ _____

_____

13. Total cost to bring treatment facilities up to an acceptable level
$ _____(1000 $)

14. Design life for new installations _____(years).

15. Treatment and Disposal System Replacement Value _____ (Million $, 1984)

Please attach any further information you may have available.

WATER SYSTEM

DISTRIBUTION SYSTEM (not including Supply, Transmission, Treatment, Storage)

* Note: 1983, 1976 & 1968 data requested. If not available note date of preferred year.	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
1. Total System Length of Mains (not service) (km)			
2. % of Population Connected			
3. Average Daily Water Demand (1000 m^3/day)			
4. Number of Emergency Repairs (breaks)			
B. Annual Costs of:			
5. Emerg. Repairs (1000 $)			
6. Scheduled Repairs (km)			
(1000 $)			
7. Pipe Replacement (including valves (km)			
& hydrants) (1000 $)			
8. Routine Operations & Maintenance (1000 $)			
9. Administ. Costs (1000 $)			
10. Other _____ (1000 $)			
11. Total Water Distribution System Budget (1000 $) (excl. new construction for expansion)			
12. Liability Claims: No.			
Payouts (1000 $)			

WATER SYSTEM (Continued)

C. Revenue

Source of Revenue for Operation, Replacement and Rehabilitation of Water System

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,
Provincial Subsidy ____ %, Federal Subsidy ____ %,
Other (explain) _____ ____ %

D. Needs

13. What standard or deficiency measure do you use to determine whether your water distribution system is functioning at an acceptable level?

_____

_____

14. a) How many km of water lines need replacing now due to lack of capacity or deterioration? _____(km).

b) Total cost to bring water distribution system up to an acceptable level (at a unit cost of $ _____ per km) is _____.(1000 $)

15. Design life for new installations _____ (years).

16. Total Water Distribution System Replacement Value _____(Million, 1984

Please attach any further information you may have available.

WATER SUPPLY, TREATMENT AND STORAGE

1. Source of Water: Groundwater _____ Surface Water _____
   Purchase from Other Authority _____
2. Brief Description of Water Supply Treatment and Storage System _____

_____

_____

* Note: 1983, 1976 & 1968 data requested. If not available note date of preferred year.

	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
3. Capacity of:			
- Source, Intake and Transmiss.(1000 m^3/day)			
- Treatment Facilities (1000 m^3/day)			
- Storage Facilities (1000 m^3)			
4. No. of emergency repairs			
B. Annual Cost of (1000 $)			
5. Prevent. Maint.			
6. Routine Operation & Maintenance			
7. Emergency Repairs			
8. Administration			
9. Other _____			
10. Total Water Supply, Treatment and Storage Budget (excluding new construction for expansion)			
11. Liability claims: No.			
Payout (1000 $)			
C. Revenues			
12. Charges for water(resid.) - per $/1000 m^3; or			
- average flat rate/yr.			

WATER SUPPLY, TREATMENT AND STORAGE (Continued)

C. Revenue

Source of Revenue for Operation, Replacement and Rehabilitation of Water Supply, Treatment and Storage

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,

Provincial Subsidy ____ %, Federal Subsidy ____ %,

Other (explain) _____ ____ %

D. Needs

13. What standard or deficiency measure do you use to determine whether your water supply, treatment and storage system is functioning at an acceptable level?

_____

_____

14. Total cost to bring water supply, treatment and storage system up to an acceptable level? _____ (1000 $, 1984)

15. Design life for new installations _____(years).

16. Replacement Value: Source, Intake, Transmission _____ (Million $)
Treatment Facilities _____ (Million $)
Storage Facilities _____ (Million $)

17. Is the applicable regulatory agency satisfied with the current operation of your system? _____

Please attach any further information you may have available.

ROADS AND BRIDGES

A. ROADS

includes: roads, pavements, curbs, ditches, culverts, sidewalks, boulevards, and above ground lighting under your jurisdiction

excludes: lanes, traffic control signals, signs and markings, underground services

* Note: 1983, 1976 & 1968 data requested. If not available note date of preferred year.	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
1. Total length of Roads (km)			
Length Paved (km)			
Length gravelled (including oiled) (km)			
2. Length of roads in your municipality not under your jurisdiction (km)			
3. Number of Emergency Repairs (callout occurrences, not included in sewer collapses or watermain breaks)			
B. Annual Cost of:			
4. Emerg. repairs (1000 $)			
5. Reconstruction of paved roads (km)			
(1000 $)			
6. Regravelling or oiling (km)			
(1000 $)			
7. upgrading gravel to paved roads (km)			
(1000 $)			

ROADS (Continued)

	Current Data (19 __)	Historical Data 7 years previous (19 __)	Historical Data 15 years previous (19 __)
8. Resurfacing paved roads (km)			
(1000 $)			
9. Sealing, patching and crack filling (km)			
(1000 $)			
10. Other roadway repairs (km)			
(1000 $)			
11. Routine Operat.& Maint. (incl.sweeping, snow removal, etc.)(1000 $)			
12. Administration (1000 $)			
13. Other _____ (1000 -$)			
14. Total Operating Budget (1000 $) (excl. new construction for expansion)			
15. Liability Claims: No.			
Payouts (1000 $)			

ROADS (Continued)

C. Revenue

Source of Revenue for Operation, Replacement and Rehabilitation

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,
Provincial Subsidy ____ %, Federal Subsidy ____ %,
Other (explain) _____ ____ %

D. Needs

16. What standard or deficiency measure do you use to determine whether your road system is functioning at an acceptable level?

_____
_____
_____

17. a) How many km of roads need replacing now due to lack of capacity or deterioration? _____(km).

b) Total cost to bring road system up to an acceptable leval (at a unit cost of $ _____ per km) is _____.(1000 $, 1984)

18. Design life for new roads _____(years).

19. Total Road System Replacement Value _____ (Million $, 1984) (excluding land acquisition)

Please attach any further information you may have available.

B. BRIDGES

* Note: 1983, 1976 & 1968 data requested. If not available note date of preferred year.	Current Data* (19 __)	Historical Data* 7 years previous (19 __)	Historical Data* 15 years previous (19 __)
A. Inventory			
1. Number of bridges			
- No. vehicular			
- No. pedestrian			
2. No. of bridges posted for reduced vehicle weight			
3. No. of bridges closed due to structural deficiencies			
4. No. of emergency repairs			
B. Annual cost of: (thousand $):			
4. Repairs and Rehabilitation			
5. Routine Maintenance			
6. Administration			
7. Other _____			
8. Total Operating Budget			
9. Liability claims: No.			
- Payouts (1000 $)			

B. BRIDGES (Continued)

C. Revenue

Source of Revenue for Operation, Replacement and Rehabilitation

General Tax Revenue ____ %, User Charges ____ %, Debt. Financing ____ %,
Provincial Subsidy ____ %, Federal Subsidy ___ %,
Other (explain) _____ ___ %

D. Needs

10. What standard or deficiency measure do you use to determine whether your bridge system is functioning at an acceptable level?

_____

_____

_____

11. Total cost to bring bridge system up to an acceptable level _____ (1000 $, 1984).

12. Design life for new installations _____(years).

13. Total Bridge System Replacement Value _____ (Million $, 1984).

Please attach any further information you may have available.

C23

FCM

March 5, 1984

SURVEY OF MUNICIPAL INFRASTRUCTURE

Further to Mayor Harcourt's letter to you of February 16, 1984 to which the infrastructure survey questionnaire was attached, we thank those of you who have already returned completed questionnaires and those of you who are on the verge of doing so for your prompt attention to this matter. We realize that the effort required is substantial and that the time allotted is short. We wish, therefore, to provide you with some additional information on the timing and aims of the study.

Over the past few months, FCM Officers have met with the Ministers of Municipal Affairs in almost every province. One of the major concerns shared by most ministers is the level of investment in municipal infrastructure. Although the situation varies somewhat from province to province, it is evident that the with- drawal of the Government of Canada from participation in municipal infrastructure programs has left a considerable vacuum.

On the basis of this concern, shared by the vast majority of municipal officials, the FCM launched a Task Force on Municipal Infrastructure last year. Following the recommendations of its Technical Advisory Sub-Committee which is comprised of about a dozen chief engineers from towns and cities across Canada, the survey you received was prepared and funds sought to cover the costs of its analysis.

Our aim is to use the information generated as a basis for policy proposals to all orders of government. While some uncertainty remains as to when this information will be most useful, the present political climate suggests a date that is sooner rather than later.

.../2

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President
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Her Worship M. Dewar
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Second Vice-President
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Québec, Québec
Past-President
Président sortant

Alderman D.A. Lawson
Burnaby, British Columbia
First Vice-President
Premier vice-président

His Worship F.J. Moran
Charlottetown, P.E.I.
Third Vice-President
Troisième vice-président

James W. Knight
Executive Director
Directeur général

The Federation intends that sufficient information will be available for its early June Conference to allow municipal leaders to establish the policy recommendations they feel most appropriate to the situation. As well, we believe that this national study will provide individual communities with a sound yardstick against which to measure their own infrastructure investment strategies.

Again, we thank you for your co-operation and to urge you to complete the survey as soon as possible. If you anticipate difficulty in meeting the March 15th deadline, we would appreciate your letting us know.

Yours Sincerely,

James W. Knight
Executive Director

JWK/fcd

C25

FCM

March 31, 1984

Dear Mayor

RE: CANADIAN INFRASTRUCTURE

In February the FCM sent out a survey to all FCM member municipalities in Canada requesting information on the state of urban infrastructure and funding availability in each municipality. This information is necessary for us to prepare a report to the Winnipeg FCM annual meeting in June. We hope the report will be the foundation upon which we begin to solve the problems facing many municipalities in Canada - the problem of deteriorating urban infra structure. With this information we not only can determine measures which we ourselves have to take, but also we can approach senior governments for assistance where necessary. In this way we can tie the necessary reconstruction of our essential public works facilities to the economic recovery of our country.

Your municipality has, as yet, not returned this very important questionnaire. It has been sent to your senior administrator and in some cases our checks show that the survey may have been misplaced or the urgency overlooked. I am, therefore, requesting that you expedite return of the questionnaire from your municipality as it is important that you be represented among the municipalities of this country in this important work. In view of the tight deadline, we would appreciate a response as soon as possible.

Yours very truly,

Michael Harcourt

Michael Harcourt
Mayor of Vancouver
Chairman, FCM Task Force on Infrastructure

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APPENDIX D

SUMMARY OF MUNICIPAL INFRASTRUCTURE RESPONDENTS

APPENDIX C
SUMMARY OF SURVEY RESPONSES (May 1, 1984)

Municipality	Province	Region	Population 1983	1976	1968
Airdrie	Alta	West	10,431	N/A	N/A
Calgary	Alta.	West	622,000	485,000	375,000
Edmonton	Alta.	West	560,085	461,559	410,105
Fort Sakatchewan	Alta.	West	12,470	8,749	4,961
Lethbridge	Alta.	West	58,086	46,818	37,760
Medicine Hat	Alta.	West	43,000	43,000	N/A
Red D e-	Alta.	West	52,057	31,544	26,730
Spruce Gro..	Alta.	West	11,307	6,827	1,110
St. Albert	Alta.	West	35,032	N/A	N/A
Abbotsford	B.C.	West	12,745	9,507	6,350
Burnaby	B.C.	West	138,000	132,000	123,000
Campbell River	B.C.	West	16,100	12,072	8,000
Chilliwack	B.C.	West	40,642	37,065	30,404
Matsqui	B.C.	West	46,000	31,178	20,000
North Cowichan	B.C.	West	18,210	15,696	11,000
North Vancouver	B.C.	West	65,325	63,950	54,837
Oak Bay	B.C.	West	16,857	16,580	18,364
Penticton	B.C.	West	23,180	21,344	15,330
Prince Rupert	B.C.	West	16,500	14,557	13,000
Richmond	B.C.	West	100,000	80,034	55,125
Surrey	B.C.	West	147,138	N/A	N/A
Vancouver	B.C.	West	415,000	415,000	440,000
West Vancouver	B.C.	West	36,951	37,144	36,440
Brandon	Man.	West	36,343	32,610	31,135
Portage La Prairie	Man.	West	13,056	12,555	13,012
Thompson	Man.	West	14,500	N/A	N/A
Winnipeg	Man.	West	597,760	586,452	N/A
Regina	Sask.	West	171,600	149,593	139,800
Brantford	Ont.	Central	76,150	70,500	61,008
Burlington	Ont.	Central	114,853	103,728	N/A
Cambridge	Ont.	Central	70,155	71,482	N/A
Gloucester	Ont.	Central	78,000	56,700	26,000
Kanata	Ont.	Central	25,000	N/A	N/A
London	Ont.	Central	270,000	247,065	200,455
Nepean	Ont.	Central	88,000	76,208	N/A
Niagara Reg.	Ont.	Central	370,781	358,663	339,166
North York	Ont.	Central	560,000	560,000	559,000
Ottawa	Ont.	Central	305,000	305,000	298,000
Pickering	Ont.	Central	40,128	28,473	30,208
Sault Ste. Marie	Ont.	Central	83,270	80,219	75,354
Scarborough	Ont.	Central	440,920	387,149	284,000
Toronto	Ont.	Central	614,763	678,103	682,819
Vanier	Ont.	Central	19,539	19,726	23,637
York	Ont.	Central	132,915	134,183	N/A

Municipality	Province	Region	Population 1983	1976	1968
Cowansville	Que.	Central	12,240	12,016	11,157
Hull	Que.	Central	59,644	N/A	N/A
Joliette	Que.	Central	16,800	21,800	20,722
Pierrefonds	Que.	Central	40,000	35,300	31,000
Quebec	Que.	Central	166,474	177,082	164,190
Shawinigan	Que.	Central	23,100	27,792	30,777
Fredricton	N.B.	East	43,723	43,000	43,000
Saint John	N.B.	East	80,321	N/A	N/A
Dartmouth	N.S.	East	63,670	63,340	58,800
District of Lunenburg	N.S.	East	24,593	N/A	N/A
Halifax	N.S.	East	114,000	117,882	N/A
Kentville	N.S.	East	39,773	N/A	N/A
New Glasgow	N.S.	East	10,674	N/A	N/A
Truro	N.S.	East	12,802	13,073	13,226
Corner Brook	Nfld.	East	24,500	25,358	27,116
Labrador City	Nfld.	East	10,000	13,000	8,000
Regional Municipalities					
Hamilton-Wentworth	Ont.	Central	415,000	411,000	N/A
Metropolitan Toronto	Ont.	Central	2,207,918	2,156,262	1,906,041
Ottawa-Carleton	Ont.	Central	569,743	521,418	445,845
NOTE:					
Montreal	Que.	Central	Response received May 11, 1984, which was too late to be included		

Respondants Not Included in Analysis

Municipality	Province	Region	Population 1983	1976	1968
Vegreville	Alta	West	5,212	N/A	N/A
Peace River	Alta.	West	6,043	5,071	4,840
Slave Lake	Alta.	West	4,562	3,449	N/A
Creston	B.C.	West	4,190	3,504	N/A
Duncan	B.C.	West	4,228	4,061	4,388
Rossland	B.C.	West	3,967	3,716	4,264
Trail	B.C.	West	9,600	9,976	N/A
Carlyle	Sask.	West	1,074	1,031	1,064
Melfort	Sask.	West	6,100	4,900	4,400
Faro	Yukon	West	800	1,760	N/A
Roxboro	Que.	Central	6,300	7,106	7,745
Sherbrooke	N.S.	East	3,030	3,107	N/A
Springhill	N.S.	East	4,896	5,220	5,380
Yarmouth	N.S.	East	7,475	N/A	N/A
Bonavista	Nfld.	East	4,460	4,219	4,192
Wabush	Nfld.	East	3,155	3,769	N/A
Parkdale	P.E.I.	East	2,019	1,945	1,900

APPENDIX E

A PROFILE OF FEDERAL GOVERNMENT SUPPORT FOR MUNICIPAL INFRASTRUCTURE IN CANADA

by

Wendy Finan

and

James W. Knight

Federation of Canadian Municipalities

FEDERAL SUPPORT FOR MUNICIPAL INFRASTRUCTURE IN CANADA

INTRODUCTION

Federal support for municipal infrastructure in Canada reached a peak in the mid to late 70's. The history of formal support for municipal infrastructure begins in 1961 with the introduction of the Municipal Infrastructure Program that was provided under the National Housing Act. Other programs that were directly targeted to municipal infrastructure included the Neighbourhood Improvement Program (NIP), initiated in 1974 and the Municipal Incentive Grant Program, initiated in 1975. These programs were consolidated and replaced in 1979 by the Community Services Contribution Program (CSCP). Another program directly related to municipal infrastructure was the Urban Transportation Assistance Program (UTAP), instituted in 1978 to provide for grade separation and improvements in local urban transit systems.

With the termination of the CSCP umbrella program in 1980 and the last payments being made by March 31st, 1984 along with the termination of the UTAP program on March 31st, 1984, all of the direct federal assistance related to municipal infrastructure has ceased.

The following profile will present background information and general funding allocations for the major programs in support of municipal infrastructure including - the Municipal Infrastructure Program (1961 to 1978), the Neighbourhood Improvement Program (1974 to 1977), the Municipal Incentive Grant Program (1975 to 1978), the Community Services Contribution Program (1979 to 1980) and the UTAP program (1978 to 1984).[1]

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1. Included from the discussion is the Winter Works Program which allocated considerable funding in the late 60's and early 70's to job creation across Canada. Many of the make-work projects could be considered to be related to capital works but the program evaluation figures that are available, historically, do not provide the statistical breakdowns that would enable us to include this category to support. The observation that can be made, however, is that the Winter Works funding added to the already considerable emphasis that the federal government was placing on the building and replacement of municipal infrastructure. An inclusion of this program would simply heighten the discrepancy between early support and the federal government's current low level of interest in the area.

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MUNICIPAL INFRASTRUCTURE PROGRAM (1961 to 1978)

The Municipal Infrastructure Program under the National Housing Act operated for eighteen years to terminate on December 31st, 1978. It developed from a budget of $40 million in 1961 to a budget of $290 million (loans) and $70 million (grants) in 1978. During this time almost 1,500 municipalities took advantage of the program representing approximately 75% of the Canadian population. All major metropolitan areas received assistance. During the years from 1971 to 1975, additional loan funds of $103 million were provided over the program's normal budget allocation to help finance projects in the Great Lakes basin area.

The Municipal Infrastructure Program grew from a concern with sewage disposal problems and, as a result, federal government funding was allocated to provide assistance in the construction of sewage treatment facilities. The Municipal Infrastructure Program funded projects which involved the construction or expansion of sewage treatment facilities as well as the installation of trunk collector sewers. Internal street sewers, which fell under other parts of the Act, were generally excluded. CMHC which was responsible for administering the Act, could cover up to 66% of the cost of projects with 25% of the loan being forgiven. Loans, under these arrangements could be made to provinces, municipalities or municipal corporations.

As a result of the CMHC initiative, many municipalities benefited. The size of loans varied from $3,000 to over $10 million and went to municipalities whose population ranged upwards from 200 people. The federal activity encouraged a number of provinces to pass legislation to make other assistance available to municipalities.

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THE 1970 MUNICIPAL INFRASTRUCTURE PROGRAM REVIEW

In 1970, the Municipal Infrastructure Program was reviewed by the Task Force on Municipal Sewage Disposal headed by George Seaden. It examined the objectives and cost-effectiveness of the program, looked at projected costs related to environmental quality and offered priorities for future federal support. Among the conclusions, the Task Force emphasized that it was the federal government's responsibility to provide leadership in problems related to urban environment. It recommended that pollution problems resulting from sewage disposal should continue to receive close attention, that the federal government should take the initiative in the research and development of disposal techniques and that funding should continue with an improved cost-effectiveness evaluation procedure. The Seaden Report determined further that:

1. the Federal policy for funding municipal sewage disposal projects should incorporate contingency provisions;

2. the Federal policy for funding municipal sewage disposal projects should consist of a broad loan fund in association with conditional grant fund(s);

3. the Federal policy for funding municipal sewage disposal projects should be considered within the context of a comprehensive national urban policy.

THE REVISION OF THE NATIONAL HOUSING ACT, 1975

In the early 70's an intergovernmental committee was set up to review the Seaden Report and modify CMHC's approach to the support of municipal infrastructure. As a result of the deliberations, the National Housing Act was revised in 1975.

The early program provided loan assistance for up to 66% of the cost of eligible work with 25% of the loan being forgiven. Eligible for this assistance were construction or expansion of facilities for treatment and the disposal of sanitary sewage as well as the construction

.../4

of sanitary trunk collector sewers. After the 1975 revisions, the option was added to allow municipalities to obtain a grant equal to 1/6 of the cost of eligible work. This alternative was elected where the municipality obtained its financing elsewhere - usually at a lower interest rate.

The 1975 revisions expanded the assistance program to include storm and water projects. They added to the list of eligible projects, the construction of storm sewers which encouraged comprehensive land use and residential development in previously undeveloped areas, as well as the construction or expansion of water supply projects which encouraged comprehensive land use and residential development in undeveloped areas. They also encouraged the development of regional sewage/water plans.

INTERGOVERNMENTAL AND INTERDEPARTMENTAL LIAISON

From the program review, it was seen to be necessary to work more closely with the provinces and with the other federal departments with program interests in the area. As a result, CMHC was directed in the mid-seventies to negotiate and sign Municipal Infrastructure Agreements with all provinces. These agreements outlined the general policy objectives of the program and contained a budget allocation for the province. The term of the agreement was approximately 5 years subject to annual review.

Another feature of the agreements was to establish a joint Federal/Provincial Committee, which consisted of six members - 3 from the province and 3 from CMHC. The Committee was responsible for monitoring and evaluating the activities under the Municipal Infrastructure Agreement, for reporting in writing to the province and to CMHC on progress and for establishing technical working committees as required. At the federal level, the departments concerned were brought together on a Federal Committee chaired by CMHC and including the Department of Environment, MSUA, DREE, Finance and Treasury Board. The Committee met twice yearly and continued (MSUA excluded) when the Municipal Infrastructure Program was discontinued in 1978 and succeeded by the Community Services Contribution Program.

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MUNICIPAL INFRASTRUCTURE PROGRAM (LOANS)

Approximately $2 billion were committed in loans during the life of the program and sewage treatment accounted for more than $1.8 billion. Ontario, Quebec and British Columbia were reported to be the main beneficiaries of the loans although all provinces took advantage of the program. The Prairies and Newfoundland received less per capita in loans than other provinces.

Alberta's relatively low use of the loan fund in the latter years was the result of a similar provincial program that offered funds at a lower interest rate. Alberta did, however, receive grants-in-lieu of forgiveness.

In Saskatchewan and Manitoba the comparatively lower response to the program was attributed to a slower, high density urban growth rate and to more accessible land used for less expensive lagoon type sewage treatment rather than the more expensive mechanical treatment plants.

In Newfoundland the lower response was related to the fiscal capacity of municipalities to repay the loan amounts.

MUNICIPAL INFRASTRUCTURE PROGRAM (GRANTS)

The grants per capita follow a similar pattern to the loans. The exception is in Alberta where grants per capita are relatively high for the same reasons that loans per capita were relatively low.

Under Section 52.1, municipalities could take advantage of the grants feature of the loans program even if they got loans from a source other than CMHC. (Alberta borrowed from the provincial government at a lower interest rate and was also eligible to receive grants for the same projects provided by CMHC in-lieu of forgiveness.)

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The eighteen-year Municipal Infrastructure Program was terminated on December 31st, 1978. The Program was replaced by the umbrella Community Services Contribution Program.

THE NEIGHBOURHOOD IMPROVEMENT PROGRAM (1974 to 1977)

The Neighbourhood Improvement Program (NIP) came into being under the National Housing Act in 1974 to encourage and support the efforts of municipalities, in concert with neighbourhood residents, towards the improvement of their physical environment and the development of social and recreational amenities. This was a joint federal/provincial program and all provinces participated with the exception of the province of New Brunswick. The federal commitment over the life of the program was $199.5 million.

Municipalities ranging in size from a population of 760 to 2.5 million participated in the program. Municipalities with a population under 2,500 received 7.8% of the total federal funding. Municipalities ranging in a population from 2,500 to 100,000 received 56.2% and the over 100,000 population received 36% of the total federal allocation.

The federal/provincial agreements allowed the federal government through CMHC to contribute 50% of the cost of the neighbourhood planning process, provision of social and recreation amenities and the acquisition of land for social housing. A 25% federal contribution was also available to offset the cost for improvement of municipal services and the acquisition and clearance of land where the existing use was not consistent whith the planned general character of the neighbourhood. The provincial contribution over the four-year program amounted to approximately $108,508 million while the total municipal contribution for all years amounted to approximately $184,631 million.

The Neighbourhood Improvement Program ended in 1978 and the program was completely phased out with all disbursements being made by 1982. The NIP program was subsumed by the CSCP program in 1978.

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MUNICIPAL INCENTIVE GRANT PROGRAM (1975 to 1978)

The Municipal Incentive Grant Program was initiated in 1975 under the National Housing Act, Section 56.2 to provide an incentive for municipalities to develop more land for modest size housing units at medium density and generally to encourage the economic use of land. A grant of $1,000 per eligible dwelling unit was made available to municipalities designated by the provincial government. The major stipulation was that the units had to be connected to municipally owned and operated water supplies and sanitary sewage systems and be serviced by a public road. There were density limitations requiring 10 to 30 units per acre, generally, except where land had been serviced for more than 5 years, 10 to 45 units per net acre were allowed. The total budget for the Municipal Incentive Grant Program was $128 million.

The Municipal Incentive Grant Program terminated in 1978 but payments were still being made until 1982. The program was replaced by the Community Services Contribution Program.

THE COMMUNITY SERVICES CONTRIBUTION PROGRAM (1979 to 1980)

The Community Services Contribution Program (CSCP) replaced three former CMHC programs; Municipal Infrastructure Program, the Neighbourhood Improvement Program and the Municipal Incentive Grant Program.

The program operated under the authority of the National Housing Act, Section 54.1 and aimed to increase the flexibility and the scope of federal funding and to better respond to local needs. It also aimed to reduce duplication in the detailed administrative procedures by making provinces responsible for project scrutiny and day-to-day administration. There was a concern that federal assistance had to meet the priorities of the provinces and municipalities and to ensure that the funding was equitably available to all provinces.

The federal/provincial agreements governing the program covered

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a two year period - the 1979 and the 1980 program years.

Annual funding for the program was allocated to a province through a formula based on its urban population and municipal tax capacity. Over the life of the program, approximately $400 million in federal funding was made available on a range of projects across Canada.

The broad categories of eligibility were sewer and water infrastructure, socio-cultural projects, recreation projects, municipal buildings projects, neighbourhood improvement projects, fire sservices projects and a miscellaneous category.

CSCP was terminated in 1980. The 1979 program payments were completed by March 31st, 1981 and the disbursement of funding under the 1980 program year was completed by March 31st, 1984. The program terminated upon completion of the pay-outs on the 1980 program year.

THE URBAN TRANSPORTATION ASSISTANCE PROGRAM (1978 to 1984)

The UTAP program was established in 1978 as a five-year, $230 million assistance program to aid provinces and municipalities in the improvement of their urban transportation infrastructure. The program Subsumed funding that was previously made available for grade separation under the Railway Relocation Crossing Act (RRCA). The funding, however, made available for grade separation under the former arrangements amounted to some $53 million for the period from 1974 to 1977 alone. The new UTAP program was extended to cover urban transit projects as well.

Owing to start-upand implimentation problems not all of the provinces were able to establish their UTAP programs in a manner that would allow them to use the available funds within the allotted time period. As a result, the program was extended by one year at the same funding level.

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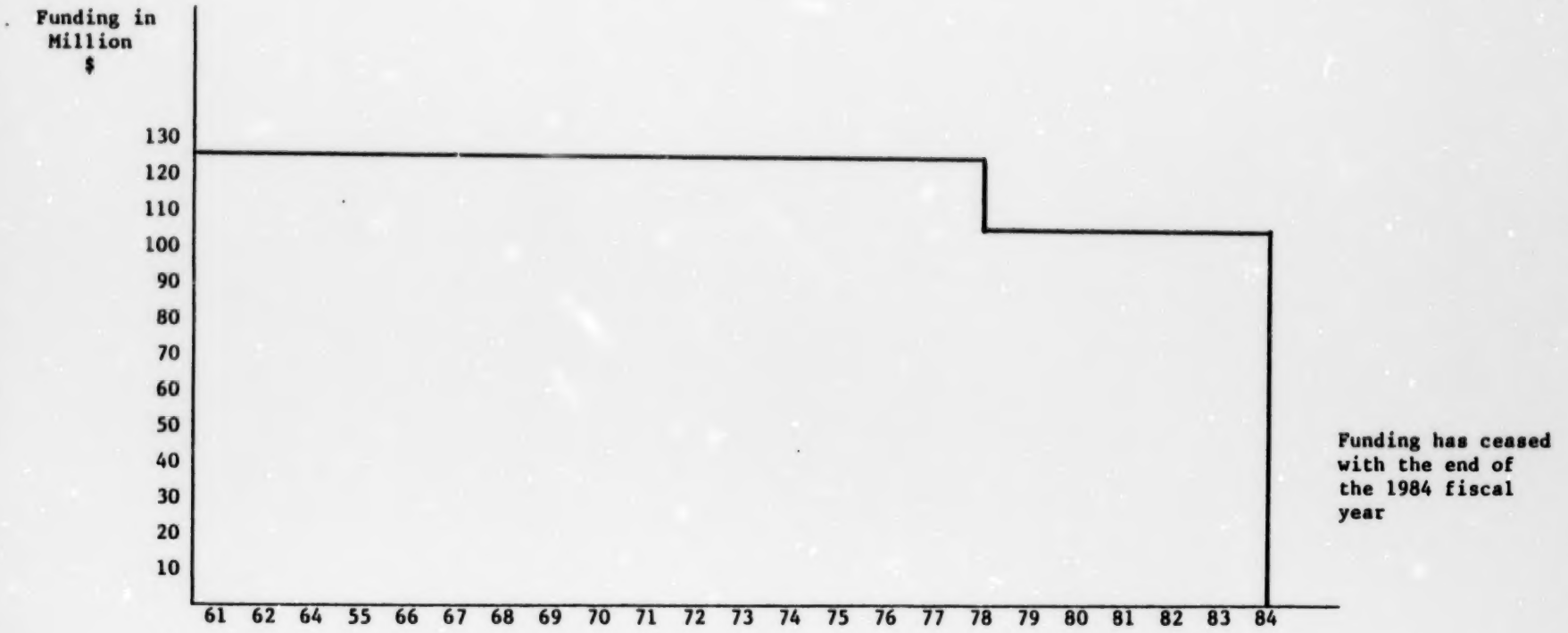
The funds were originally allocated to the provinces on the basis of $10 per capita and the projects eligible fell into two main categories - (1) projects under the Railway Relocation Crossing Act, including railway grade separations, railway relocation studies and railway relocation; (2) urban transit projects, including the acquisition of commuter rolling stock, the construction of commuter stations, the acquisition of transit buses, the construction of transit maintenance and storage facilities, of bus ways and of improved accessibility to the handicapped. The program terminated at the end of March 1984. During the past year the matter has been under extensive discussion prior to a Cabinet decision about the future of this program.

THE TERMINATION OF FEDERAL PROGRAMS RELATED TO MUNICIPAL INFRASTRUCTURE

The accompanying graph shows the federal municipal infrastructure funding averages from 1961-1984 and depicts the federal government's withdrawal of support from the area. This withdrawal becomes even more dramatic when the inflation factor is taken into consideration. The infrastructure improvements purchased for $1.00 in 1971 now require $2.77. That means that funding levels would have had to almost triple from 1971 levels in order to have the same improvement impact today. All figures in this report, including those reflected in the attached graph, are in current dollars, not adjusted for inflation. Neither does this report include those federal dollars channelled to employment generation programs. Such programs, common to the late sixties and early seventies, directed large amounts of capital to municipal infrastructure work. Such support has been much less evident in recent years, and where it has been available the criteria for involvement have been such as to limit the capacity of municipal governments to take advantage of the programs.

FIGURE 1

AVERAGE ANNUAL LEVELS OF FEDERAL FUNDING FOR
MUNICIPAL INFRASTRUCTURE IN
CURRENT DOLLARS



Included are the following programs:

1)	Municipal Infrastructure Program (1961-1978)	$ 2	Billion
2)	Neighbourhood Improvement Program (1974-1977)	$199.5	Million
3)	Municipal Incentive Grant Program (1975-1978)	$128	Million
4)	Community Services Contribution Program (1979-1980)	$400	Million
5)	Urban Transportation Assistance Program (1978-1984)	$230	Million

** ADDENDUM TO **

CANADA'S URBAN INFRASTRUCTURE

PHYSICAL CONDITION AND FUNDING ADEQUACY

[SURVEY RESULTS FOR MUNICIPALITIES WITH POPULATIONS LESS THAN 10,000]

Prepared for the Federation of Canadian Municipalities
Task Force on Municipal Infrastructure
by the
TECHNICAL COMMITTEE
ON
CANADA'S URBAN INFRASTRUCTURE

JUNE 1984

Survey Results for Municipalities with Populations Less than 10,000

Introduction

Due to the reasons cited in Section V.3.1 of the report, those municipalities with populations less than 10,000 were not included in the analysis. However, for the benefit of those municipalities that did respond in this size category, we have carried out a similar type of analysis as was done for the urban centres. The results should not be considered to be representative of all small communities in Canada. They are only a combination of the replies from the 17 respondents.

The table and figure numbers are the same as those for the analogous tables and figures in the body of the report. Some of the tables and figures in the main report have not been included here due to either a lack of significant data or time constraints. If more information is required at a later date please contact G.W. Heinke, Professor and Chairman, Department of Civil Engineering, University of Toronto, 35 St. George Street, Toronto, Ontario, M5S 1A4, (416) 978-3096.

Survey Response (Table 1, Figs. 4.1 and 4.2)

- In Canada, 84% of the municipalities with populations greater than 1000 have populations less than 10,000. However, these municipalities make up only 23% of the population.

- FCM members (our survey sample) includes only 104 of the 1847 municipalities of this size and only 10% of their population.

- Questionnaires, completed to any extent, were received from 17 municipalities representing 2% of the population of this category.

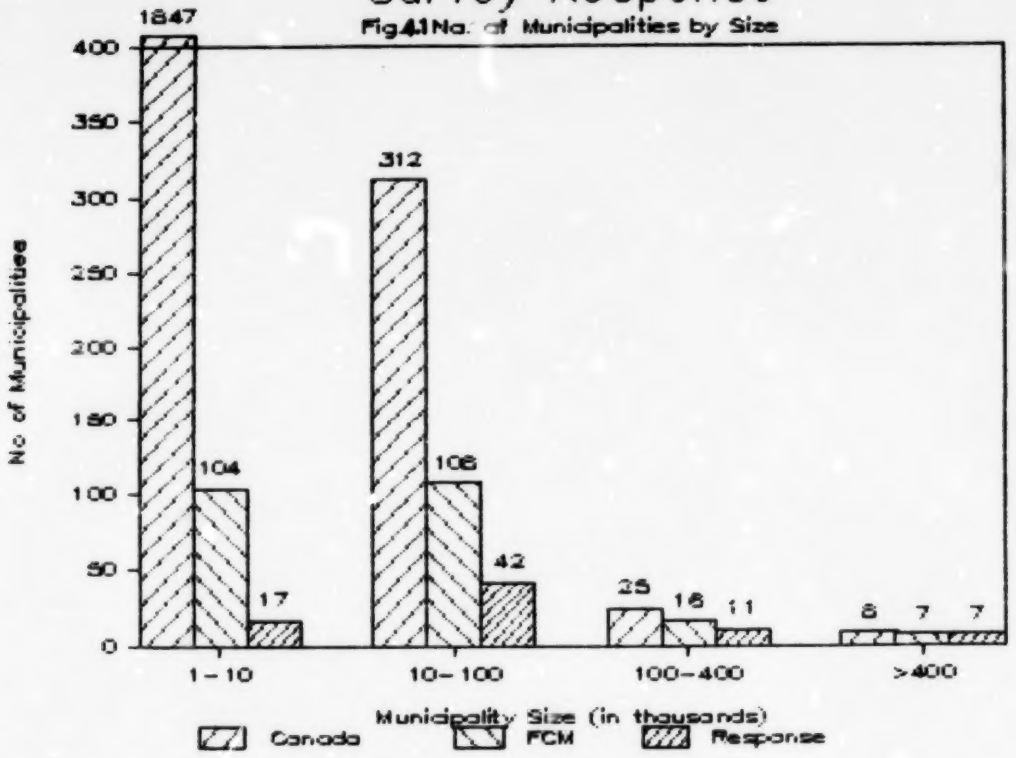
SUMMARY OF SURVEY RESPONSE
Table 1

Population Group	Response* Number	Response* Population	FCM Members Number	FCM Members Population	Canada Number	Canada Population
1-10	17	85,493	104	545,274	1847	5,331,004
10-100	42	1,521,074	108	3,394,207	312	8,825,783
100-400	11	2,030,761	16	2,830,064	25	4,484,143
>400	7	3,810,528	7	3,810,528	8	4,707,565
Eastern	16	449,291	68	1,045,340	251	1,595,457
Central	23	3,614,032	77	5,457,340	1,391	15,423,480
Western	38	3,384,533	90	3,972,837	550	6,329,558
Total	77	7,447,856	235	10,580,073	2,192	23,348,495

*Responses were also received from 3 Regional Municipalities with a combined population of 928,524 not included in the above total.

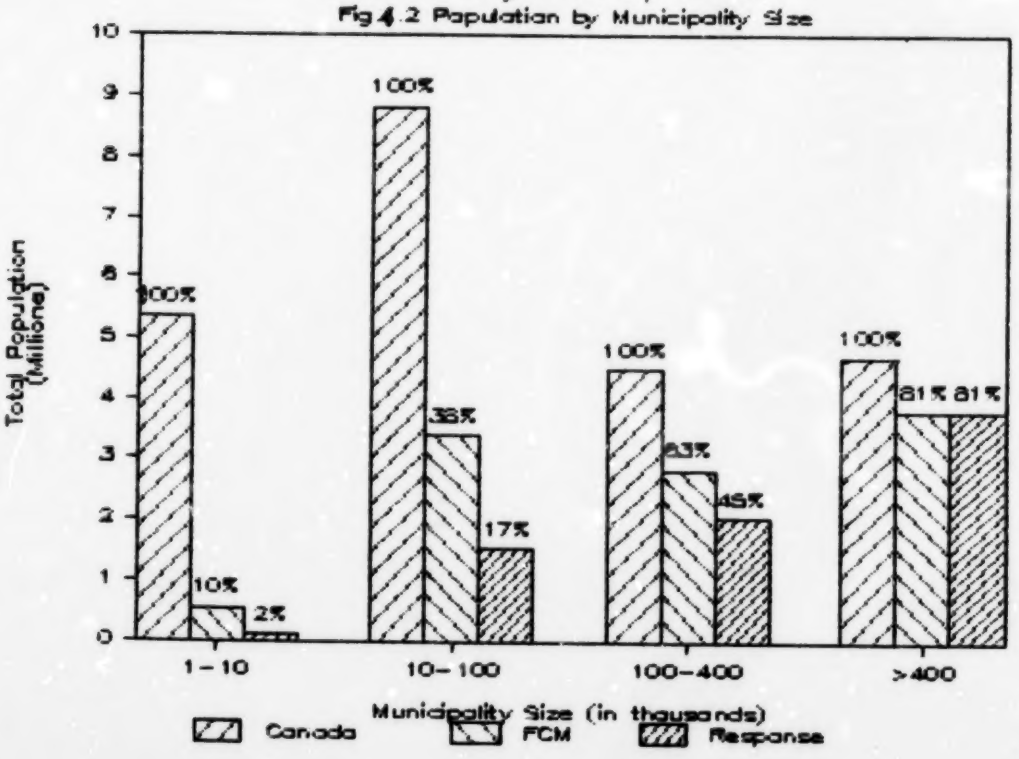
Survey Response

Fig 4.1 No. of Municipalities by Size



Survey Response

Fig 4.2 Population by Municipality Size



Infrastructure Condition (Table 2.2, Figs. 5.2 and 7)

- Those facilities considered to be in the greatest need are roads and sidewalks. There was also a significant response indicating water distribution and sewage collection systems to be in need of repair.

- Most of the facilities in the small municipalities had a larger response for the 'needs repair condition' than for those in the larger municipalities.

- There was also a smaller 'not applicable' response for facilities in the small municipalities, particularly for water treatment, sewage treatment, public buildings and parks. This indicates a greater concentration of responsibilities in these municipalities compared to the urban centres.

- Almost all facilities had a greater response for 'improving condition' than for 'deteriorating condition'.

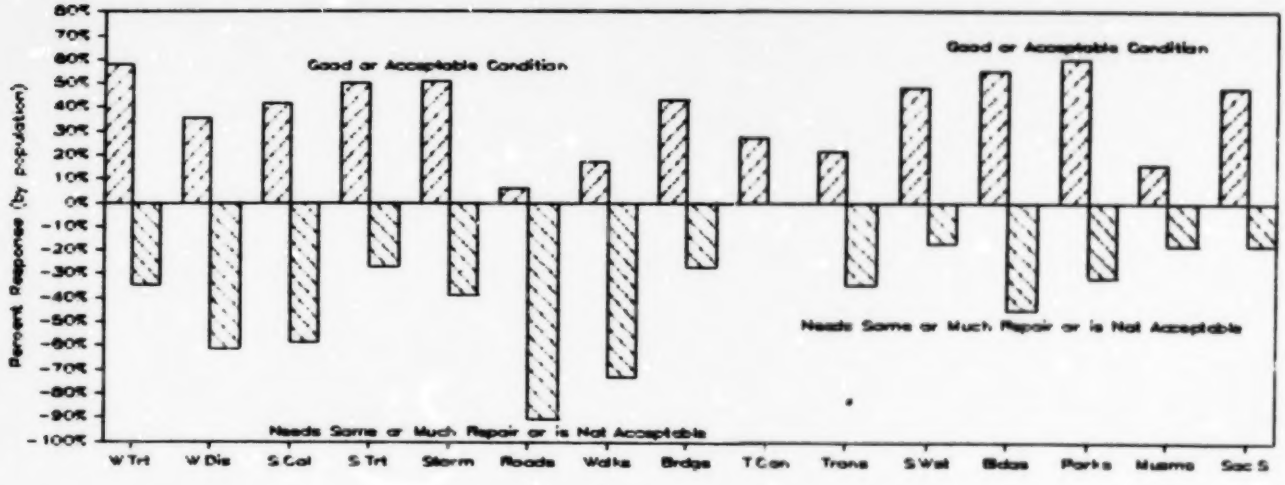
- The facilities most often seen to be deteriorating are roads, sidewalks and sewage treatment.

SUMMARY OF CONDITION OF INFRASTRUCTURE
Table 2.2 Percent of Population Responding 17 Municipalities

	Age		Present Condition						Priority for Expenditure				Change in Condition			
FACILITY	Resp	Avg Age	Resp.	good	ok	some rep.	much rep.	no good	n/a	Resp.	1st	2nd	3rd	Resp.	Better	Same	Worse
Water Treat.	75%	20	93%	32%	26%	22%	0%	13%	7%	57%	15%	22%	19%	82%	56%	14%	12%
Water Dist.	79%	26	96%	24%	12%	44%	16%	0%	4%	54%	33%	2%	18%	79%	50%	22%	7%
Sewage Coll.	82%	26	100%	11%	31%	52%	6%	0%	0%	57%	37%	2%	18%	82%	35%	35%	12%
Sewage Treat.	42%	10	77%	42%	9%	8%	5%	13%	23%	47%	15%	7%	25%	59%	20%	21%	18%
Storm Sewer	72%	16	90%	7%	44%	39%	0%	0%	10%	46%	16%	20%	10%	72%	41%	21%	11%
Roads	56%	14	96%	1%	5%	73%	10%	7%	4%	60%	33%	22%	5%	73%	48%	0%	26%
Sidewalks	72%	17	90%	0%	17%	48%	25%	0%	10%	42%	22%	14%	6%	68%	31%	7%	29%
Bridges	64%	9	70%	23%	20%	20%	0%	7%	18%	27%	9%	5%	14%	58%	31%	27%	0%
Traf.Control	16%	15	27%	18%	9%	0%	0%	0%	73%	16%	0%	7%	9%	16%	9%	7%	0%
Transit	32%	45	56%	0%	21%	33%	1%	0%	44%	20%	11%	0%	9%	40%	0%	27%	12%
Solid Waste	40%	13	65%	14%	34%	6%	4%	7%	35%	24%	4%	0%	20%	44%	15%	22%	7%
Pub. Bldgs.	66%	25	100%	11%	44%	31%	15%	0%	0%	32%	13%	0%	19%	77%	39%	30%	8%
Park/Rec.	62%	18	91%	11%	48%	30%	0%	1%	9%	43%	11%	18%	13%	73%	37%	35%	1%
Cultural	12%	16	34%	5%	11%	12%	6%	0%	66%	5%	0%	0%	5%	12%	11%	0%	1%
Soc. Services	43%	16	66%	9%	39%	18%	0%	0%	34%	15%	0%	5%	10%	37%	12%	13%	12%
Others	5%	10	5%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	5%	0%	5%	0%

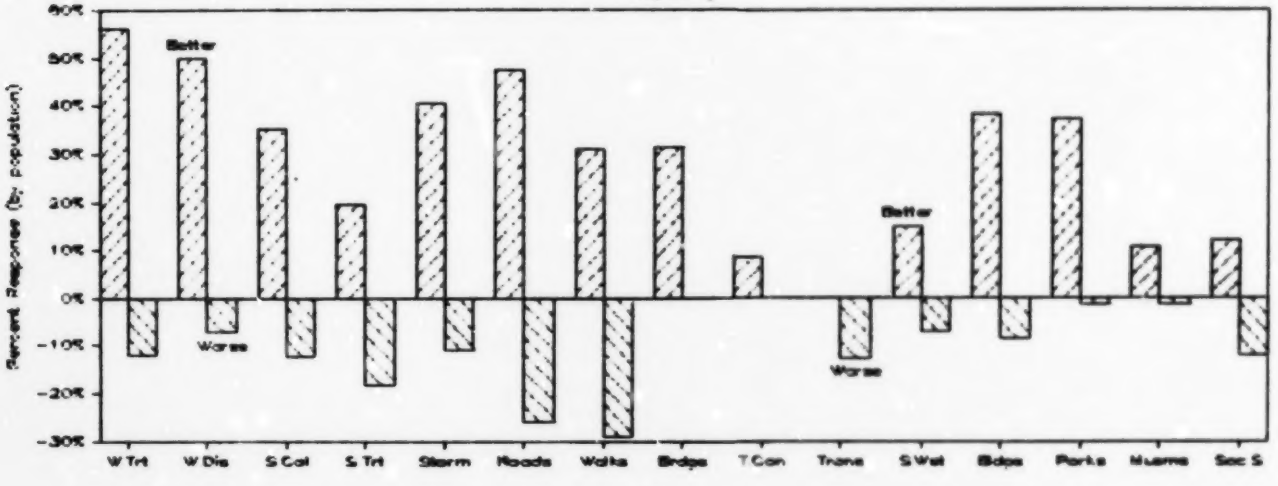
Infrastructure Condition

Figure -5.2



Change in Condition

Figure 7-



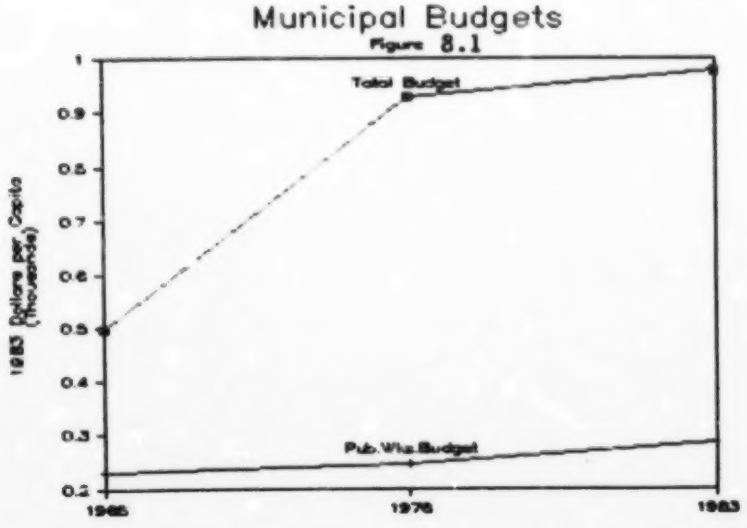
Municipal Budgets (Table 3, Fig. 8.1)

- **Total municipal expenditures have increased by 540% over the last 15 years. This represents an increase of almost 100% in constant dollars. On the other hand, Public Works expenditures have increased by only 340% over the same period, representing an increase of 24% in constant dollars.**

- **Public Works received over 40% of the Total Budget in 1968 but less than 30% in 1976 and 1983.**

PER CAPITA MUNICIPAL BUDGETS (in dollars of day)
Table 3 Total Survey of 17 Municipalities

Population 85,493	Dollars per Capita (Responses) 1968	1976	1983	% of Total 1968	1976	1983
Total Budget	$151	$508	$978	100.0%	100.0%	100.0%
Pub.Wks.Budget	$65	$141	$286	42.7%	27.8%	29.2%
T. Operating	$118 (8)	$395 (14)	$796 (16)	78.1%	77.8%	81.4%
PW. Operating	$39 (6)	$64 (13)	$165 (15)	25.7%	12.5%	16.9%
T. Capital	$27 (7)	$85 (11)	$155 (14)	18.1%	16.8%	15.9%
PW. Capital	$23 (5)	$81 (9)	$115 (11)	15.5%	15.9%	11.8%
Debt	$25 (4)	$10 (10)	$101 (13)	16.4%	1.9%	10.3%



Summary of Costs and Impediments to Improvement (Infrastructure Needs) (Tables 5.1, 5.2, 6.2, Figures 10.2 and 11.2)

Tables 5.1 and 5.2 present data on the costs needed to upgrade existing facilities to an acceptable level. The data for the larger municipalities are also repesented for comparison purposes.

- From Table 5.1, the total needs of the small municipalities represent only 1% of the total needs of all respondents.

- From Table 5.2, the per capita needs of the small municipalities are either higher or similar to the per capita needs of the large municipalities in all areas except for bridges.

- Roads are perceived to be in the greatest need of money for repairs. This corresponds to the finding that roads are considered to be in the worst condition.

- Of the 10 respondents to the question on impediments to infrastructure solutions, all ranked "Lack of Funds" as their greatest impediments.

- The next most important impediments were "Political Inaction" and "Red Tape".

SUMMARY OF COSTS TO BRING FACILITIES UP TO AN ACCEPTABLE LEVEL
Table 5.1 80 Municipalities Surveyed

Population 8,376,380 Group	Millions of Dollars (No. of Responses) Sewage Collection		Sewage Treatment		Water Distrib.		Water Treatment		Roads		Bridges		Total
1-10	$7	(14)	$6	(7)	$10	(13)	$6	(9)	$22	(11)	$0	(1)	$51
10-100	$154	(27)	$75	(19)	$86	(26)	$155	(21)	$487	(32)	$41	(24)	$998
100-400	$237	(8)	$17	(3)	$50	(6)	$21	(4)	$461	(9)	$90	(8)	$876
>400	$411	(7)	$371	(6)	$493	(7)	$312	(6)	$1,121	(7)	$374	(7)	$3,080
Western	$492	(28)	$293	(22)	$467	(32)	$316	(19)	$1,118	(31)	$343	(20)	$3,028
Central	$165	(14)	$169	(6)	$108	(9)	$133	(11)	$898	(21)	$161	(19)	$1,634
Eastern	$152	(14)	$7	(7)	$65	(11)	$45	(10)	$74	(7)	$0	(1)	$343
TOTALS	$809	(56)	$469	(35)	$639	(52)	$494	(40)	$2,091	(59)	$504	(40)	$5,006
PERCENT	16.2%		12.8%		41.8%		9.9%		41.8%		10.1%		100.0%

SUMMARY OF COSTS TO BRING FACILITIES UP TO AN ACCEPTABLE LEVEL
Table 5.2 80 Municipalities Surveyed

Population 8,376,380 Group	Dollars per Capita (No. of Responses) Sewage Collection		Sewage Treatment		Water Distrib.		Water Treatment		Roads		Bridges		Total
1-10	$95	(14)	$201	(7)	$158	(13)	$144	(9)	$402	(11)	$0	(1)	$601
10-100	$147	(27)	$112	(19)	$96	(26)	$218	(21)	$402	(32)	$42	(24)	$634
100-400	$173	(8)	$25	(3)	$59	(6)	$22	(4)	$254	(9)	$55	(8)	$431
>400	$96	(7)	$87	(6)	$105	(7)	$73	(6)	$239	(7)	$80	(7)	$658
Western	$162	(28)	$123	(22)	$144	(32)	$151	(19)	$355	(31)	$119	(20)	$895
Central	$50	(14)	$55	(6)	$37	(9)	$37	(11)	$203	(21)	$37	(19)	$360
Eastern	$350	(14)	$38	(7)	$218	(11)	$152	(10)	$373	(7)	$0	(1)	$764
AVERAGE	$97	(56)	$56	(35)	$76	(52)	$59	(40)	$250	(59)	$60	(40)	$598
PERCENT	16.2%		9.4%		12.8%		9.9%		41.8%		10.1%		100.0%

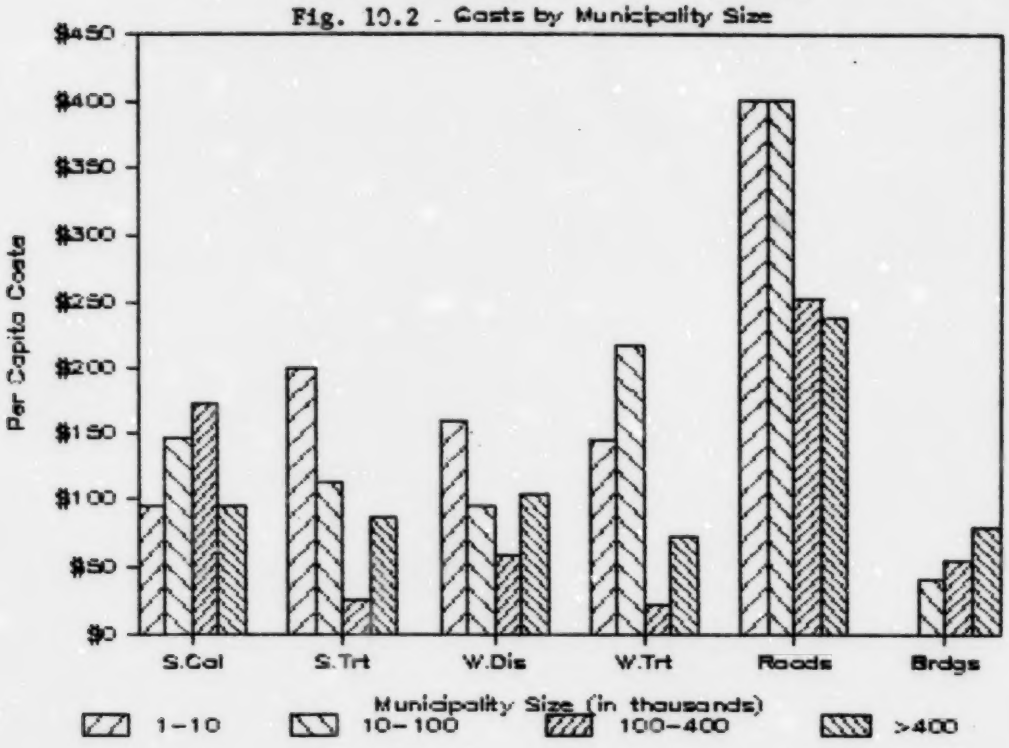
IMPEDIMENTS TO INFRASTRUCTURE SOLUTIONS
Table 6.2

Rank of Impediment	Percent of Population Responding (No. of Municipalities)									
	Funding Shortage		Public Involvment		Lack of Staff		Political Inaction		Red Tape		Other	
Greatest=1	100.0%	(10)	0.0%	(0)	0.0%	(0)	17.5%	(2)	10.8%	(1)	0.0%	(0)
2	0.0%	(0)	0.0%	(0)	8.7%	(1)	30.2%	(3)	12.2%	(2)	0.0%	(0)
3	0.0%	(0)	2.4%	(1)	13.5%	(1)	0.0%	(0)	22.2%	(2)	0.0%	(0)
4	0.0%	(0)	0.0%	(0)	2.4%	(1)	8.7%	(1)	7.0%	(1)	0.0%	(0)
Least=5	0.0%	(0)	83.7%	(8)	61.5%	(6)	36.3%	(4)	33.9%	(3)	0.0%	(0)

Percent of Population Responding	100%	(10)
Percent of Population Not Responding	0%	(7)

Infrastructure Needs

Fig. 10.2 - Costs by Municipality Size



Impediments to Infrastructure Solutions

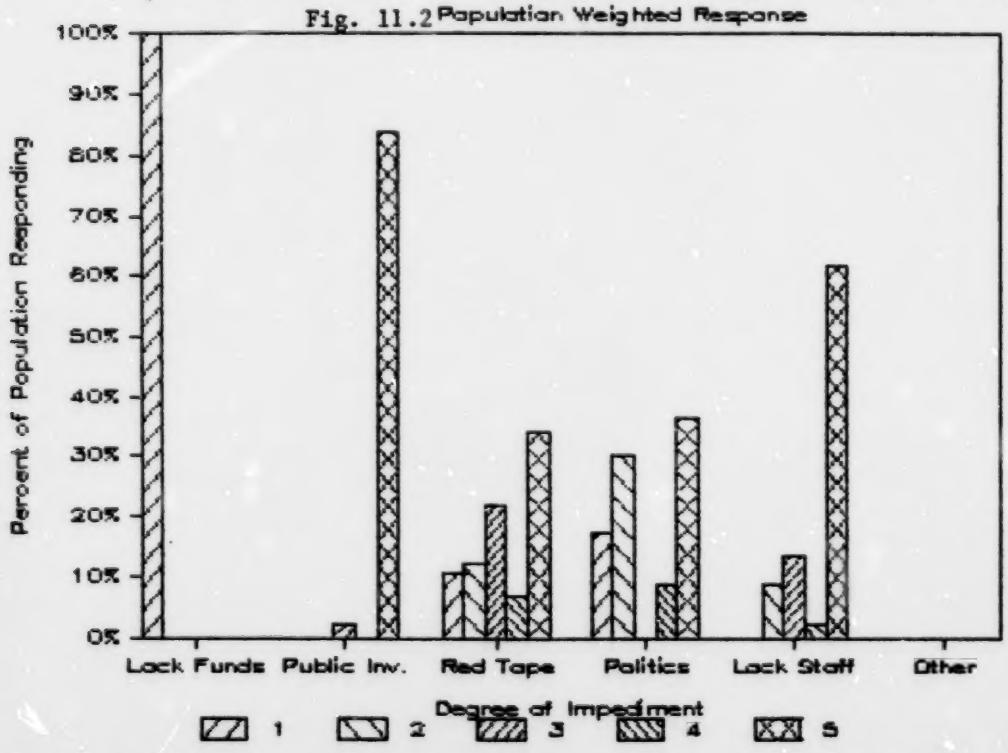



Fig. 11.2 Population Weighted Response